COAL AGE

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Power at Coal Mines

IN the past there seems to have been a more or less general opinion that the cost of power generated and used at a colliery was so low as to be unworthy of serious consideration. This condition of affairs was probably due to the fact that the coal used for generating the steam was considered to have little or no value, because it was taken direct from the mine, and further, it is likely in many instances, that no accurate records were kept of the amount of fuel used, or the actual cost of steam generation. If it had been necessary to purchase the coal, the value of the power used would probably have been considered from an entirely different point of view.

The Delaware, Lackawanna and Western Railroad Co. is a leader in the matter of economy at colliery power plants. The modernization of the D. L. & W. stations, and the high efficiency to which this company's equipment has been brought, are due principally to the engineering skill of its electrical expert, H. M. Warren. We, therefore, commend this foreword, written for us by Mr. Warren, to every COAL AGE reader who is interested in the important problem of "Power at Coal Mines"—*Editor.*

In later years however, conditions have changed. The various costs of mining and preparing coal have, for well-known reasons, constantly increased, and as a result the value of the fuel has followed along the same lines. It is not at all surprising, therefore, that in the endeavor to check, so far as possible, the increasing cost of operation, the cost of power generation should receive its due consideration.

When the cost of steam generation is not considered of any great importance, it follows that the economy of the engines or other apparatus using steam as a motive power, can hardly be given serious consideration. As a result of this line of thought, the first cost of the equipment for generating and using steam would naturally be considered the most important item.

The old equipment, therefore, consisted of the simplest type of boilers, namely, the well-known "cylinder boiler;" steam pipe lines either bare or inadequately covered, simple engines, and pumps of the slide-valve type. This combination gave first, an extremely inefficient generating plant; second, an inefficient transmission, and third, an inefficient steam-driven equipment. The line of procedure along which improvements have been made, is approximately as follows:-

The old boilers have been eliminated, and in their place we now see modern plants containing water-tube boilers, designed with special reference to the conditions under which they must operate. The chief considerations in this connection are (1) the type and size of furnace, and (2) the selection of grates, which latter should burn the desired fuel efficiently and at a high rate of combustion. The first, in order that the water evaporated per pound of coal may be high; the second, that the capacity of the boiler may be increased as much as possible, in order to keep down the fixed charges on the equipment.

As a means of increasing the rate of combustion, it is customary to use some of the various schemes of producing forced draft, the particular method used depending upon conditions. Open type feed-water heaters raise the temperature of the feed water to approximately 210 deg., and, in some instances, economizers are used to effect a further saving, and increase the feed-water temperature to a still higher point.

In the more recent installations steam turbine-driven centrifugal boiler-feed pumps have taken the place of the feed pump of the customary direct-acting type. This change is due to the simplicity and low cost of maintenance of the centrifugal equipment, as well as

the elimination of the pulsating water pressure that may occur with a direct-acting outfit. Some few plants are provided, and others are being equipped with superheaters, as a means of increasing the economy of the steam-driven equipment, and the elimination of a large amount of condensation that is bound to occur in the various steam lines. I believe that the use of superheaters designed for a moderate degree of superheat, will receive more serious consideration for boiler plants of this kind in the future, than they have in the past.

Thus we have the generating outfit designed and installed with particular reference to the conditions under which it is to operate.

The steam lines used to transmit power are of improved construction, and particularly well protected by some good heat-insulating material. The steam-driven power equipment purchased during recent years has been of a more or less improved type, such as compound, and in some instances, triple expansion pumps and engines of the Corliss or non-releasing four-valve type, simple or compound as might be desired. The pumps and engines, where conditions warrant, are operated condensing.

For the generation of electric power, it has now become quite customary to use steam turbine-driven generators, operating condensing where possible. In a few instances exhaust steam turbine-driven generators are in use. These units generate the power from exhaust steam, which had formerly been wasted by being allowed to blow directly to the atmosphere. Where the supply of exhaust steam is intermittent, such as the exhaust of hoisting engines, some form of heat accumulator or regenerator is necessary to absorb heat, while the engines are operating, and give it up while they are at rest, acting as a sort of heat "fly-wheel." The use of this type of equipment will increase rapidly in the future.

Electric power is transmitted various distances, and used for several purposes, for which steam was formerly employed, and in addition, furnishes power for lighting and portable equipment, such as electric locomotives, coal-cutting machines, and also electrically-operated coal and rock drills.

As the object of installing efficient equipment is to produce economical results, the mere installation of such an equipment is not sufficient. It is equally important that it be kept in such condition continually as to produce the highest practical economy, and in addition, no power should be wasted. Therefore the organization should be such, and it should be someone's duty to see, that the equipment is kept up and operated in such a manner as to insure the best results. It is entirely practicable to do this, but the situation must be handled in some systematic manner, and accurate records must be kept to show the actual operating costs, including all charges, from month to month.

The boiler plant records should show the amount of water evaporated, and the coal burned per month, the cost of labor and material for operation, also the same items for maintenance. It is likewise advisable to have a constant record of the boiler feed-water temperature, and the steam pressure. The record of the water pumped into the boilers may be kept by a Venturi or some other type of recording instrument. The coal may be either weighed, or measured by passing through a coal meter.

To maintain efficiency, careful attention must be paid to the method of firing. The amount of coal in the ash must be kept at a minimum. Gas analyses and stack temperatures should be made, to see that proper combustion is taking place, and that an excessive amount of air is not entering through the boiler settings; also that the baffles of the boilers are in good shape, and do not permit the short circuiting of the gases.

Waste of steam through leaky joints or drains should be avoided, and the steam-using equipment should be kept in efficient condition. There should be a frequent inspection to see that everything is in good order, and that losses are not occurring through open drains. The equipment should be indicated to insure proper setting of the valves.

Probably one of the best, if not the best method of discovering the use of excessive amounts of steam in various equipment, is to install a steam meter in the steam line, and take indicator cards of the equipment at the same time. This will give the rate of steam combustion per indicated horse power per hour, which in a great many instances will be surprising.

Take for example, a steam line leading down a shaft. The steam meter is placed in this line, and a record obtained for 24 hours. During this period the various equipment taking steam from this line is indicated, and the number of hours of operation recorded; thus the steam consumption per i.hp. used during the 24 hours, may be obtained. Such information is more valuable than any data that can be obtained by the use of indicator cards only. With this data available, it is a comparatively easy matter to determine what should be done in order to improve conditions.

In conclusion, "Power at Collieries" is an important subject, and as such, should receive careful consideration. All equipment should be designed for the purpose intended, and each installation should be maintained so as to operate at as high an efficiency as is practicable.

A Large Anthracite Power Plant

By Frank H. Kneeland

SYNOPSIS—A plant which is neat in external appearance and efficient in operation. The boilers are all of the water-tube type, fed by centrifugal turbine-driven pumps. The prime movers of all the generating units are steam turbines operating condensing, mine water being utilized for this purpose.

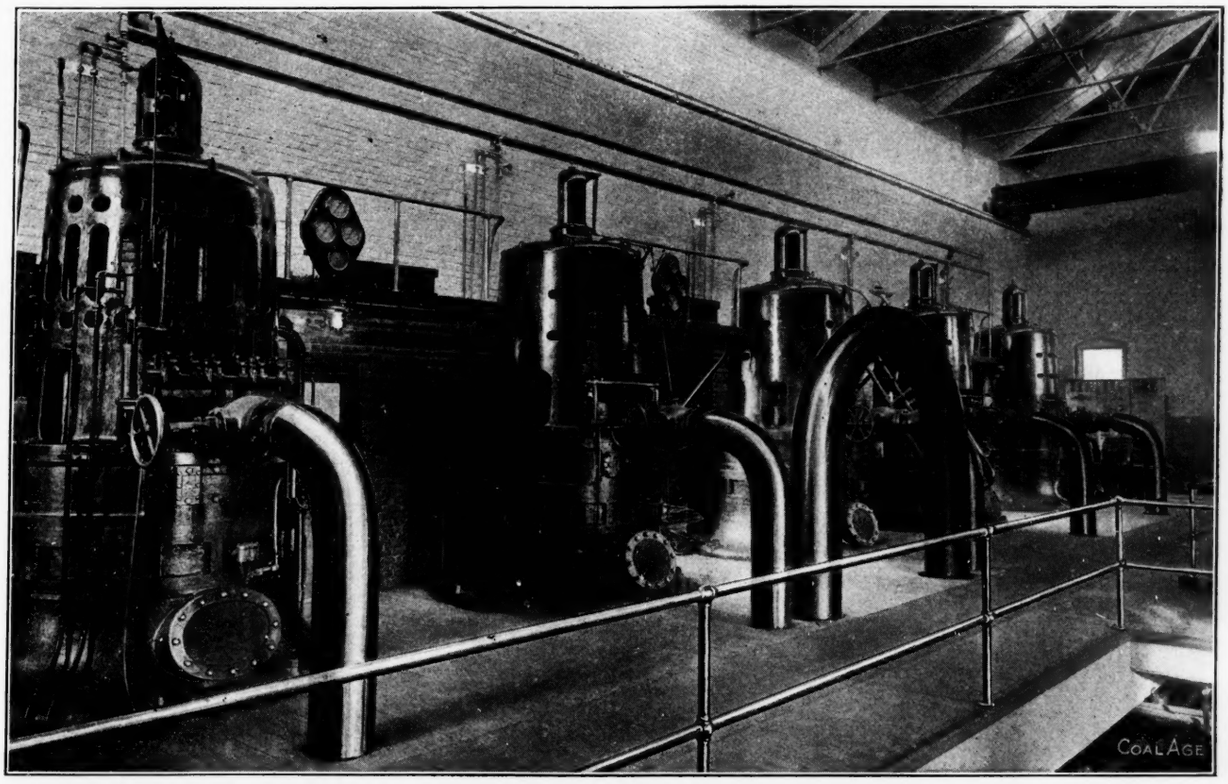
In coal mining, as in many other industrial activities, two general types of power plants appear to exist. These are, first, the plant which is designed and constructed in its entirety at once, and, second, the plant which is started with few or small units, and which from time to time has been augmented and added onto until the final result is perhaps many times the magnitude of the original installation.

Of these two, the former is usually the more efficient. In such installations the end may be clearly perceived from the beginning, and the amount of necessary material, together with the desired head room, side clearance and other circumstances conducive to the greatest possible convenience, may be readily foreseen and calculated to a nicety.

Unfortunately, however, such plants as these are the exception rather than the rule, particularly where power is strongly centralized and generated in large quantities. The ever-increasing demand for fuel, and the constantly growing applications of power to mining purposes, has rendered it difficult to accurately predict the ultimate requirements of any colliery or group of collieries. The result has been that plants which were at first deemed adequate for all possible requirements have been first overloaded, then added onto, again overloaded and again added to, until, in their final shape, they greatly exceed the magnitude with which they started.

In such cases, no matter how efficient the plant may be thermodynamically, it is seldom arranged for the greatest possible accessibility and convenience, and both the first cost and the attendance are usually higher than when the ultimate magnitude of the entire installation may be foreseen from its first inception.

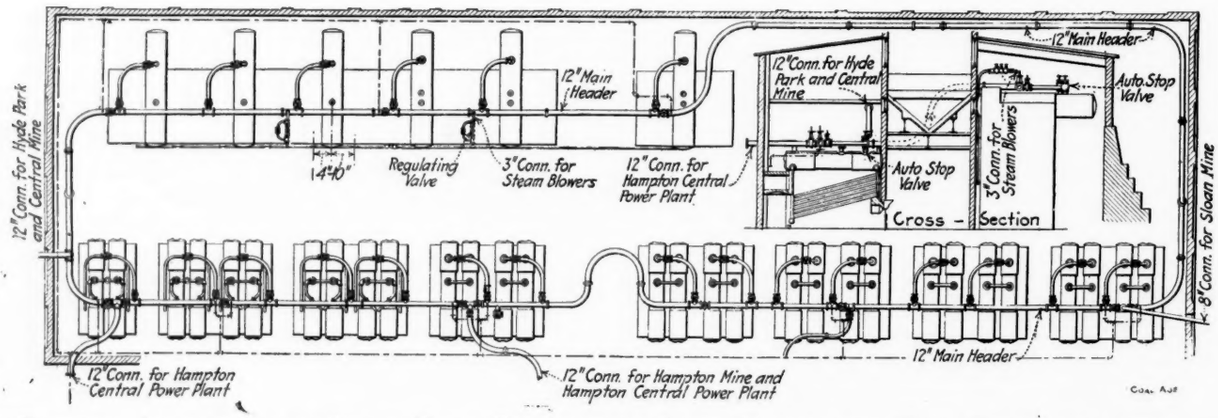
There are, however, some notable exceptions to the general rule. Some instances exist wherein a plant, even though it be composed of a series of additions to the original equipment, presents not only an efficient whole, but also a neat and convenient appearance. The Hampton plant of the Coal Department of the D. L. & W. R.R. Co., near Scranton, Penn., may be justly regarded as a good example of such an installation. Although several additions to the equipment have been made from time to time, the plant as it exists today is both convenient and efficient.



Interior of Power House, Showing the Vertical Turbo-generators Also Electrically Driven Exciter

Size and Arrangement of Boiler Plant

Exclusive of the main flues and economizers, the boiler house at this plant is 244 ft. 10 in. long by 75 ft. 7 in. wide. It is constructed of brick with steel roof trusses


12" Conn. for Hyde Park and Central Mine
12" Main Header
14"x10"
Regulating Valve
3" Conn. for Steam Blowers
12" Conn. for Hampton Central Power Plant
12" Conn. for Hyde Park and Central Mine
Auto Stop Valve
3" Conn. for Steam Blowers
Cross - Section
12" Main Header
3" Conn. for Sloan Mine
12" Conn. for Hampton Central Power Plant
12" Conn. for Hampton Mine and Hampton Central Power Plant
12" Main Header

INTERNAL ARRANGEMENT OF BOILER HOUSE, EXCLUSIVE OF FLUES, ECONOMIZERS, FANS, PUMPS AND OTHER AUXILIARIES

and concrete floors. The building contains 15 Babcock & Wilcox boilers of 313 rated hp. each. One of these is set singly and the balance in seven batteries of two boilers each. There are also six 2-drum Stirling boilers of 630 hp. each placed in battery.

The two types of boilers are arranged facing each other on opposite sides of a single firing alley of ample width to allow easy manipulation of slice bars, hoes and other firing tools.

It should be noted also that placing the 2-drum Stirling boilers in battery not only decreases the cost of the boiler settings, but also diminishes the heat radiation losses to a minimum.

Nos. 1 and 2 barley coal is used as fuel. This is first dumped from railroad cars into a pocket outside of the building. From here it is elevated and transported to an overhead bunker above the firing alley by means of a belt conveyor provided with an automatic tripper. Suitable downcomer pipes lead from the bunker to the Parsons distributors, with which each boiler is provided. Another series of these pipes also carries the coal to the floor in the middle of the firing alley, so that a supply for stoking the boilers by hand is always convenient.

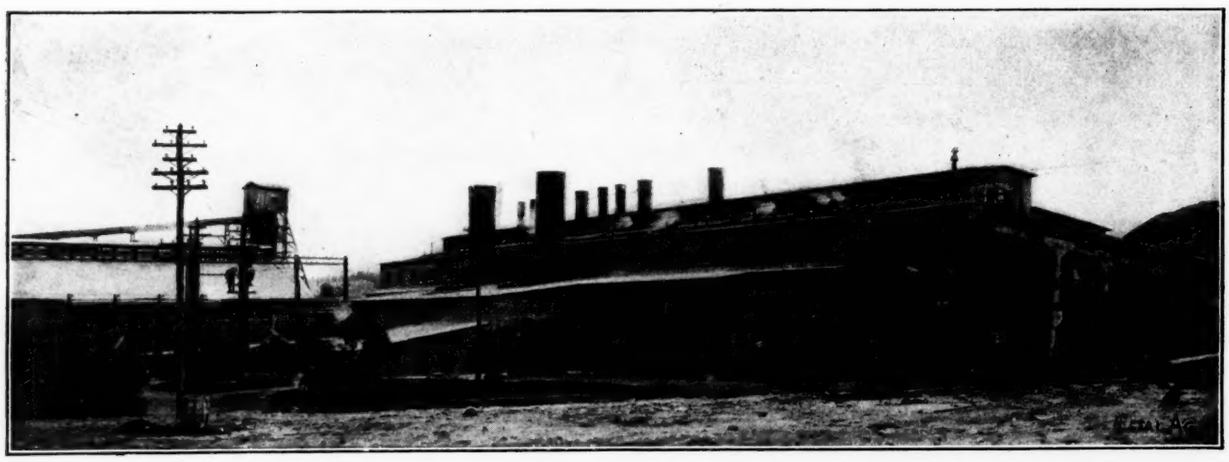
The Parsons spreaders above mentioned handle about 70% of the fuel requisite for operation. The balance, or 30%, is hand fired.

A draught pressure of about 2 in. of water is maintained under the grates by means of two forced draught fans 16 ft. in diameter and 5 ft. wide, direct-connected to steam engines operating at approximately 200 r.p.m. On the Stirling boilers, Parsons steam blowers are used in place of the forced-draught fans. After leaving the Babcock & Wilcox boilers the flue gases are passed through Green fuel economizers. For this purpose two induced-draught fans, 18 ft. in diameter by 7 ft. long, direct-connected to steam engines and driven at approximately 140 r.p.m., are employed. The suction at the intake of these fans is about 2½ in. of water.

ASH DISPOSAL AND WATER FEED

The ashes are flushed from the pits below the grates into the old workings of the mine through a borehole. Feed water is supplied to the boilers by two 5-in., 4-stage centrifugal pumps, each having a capacity of 500 gal. per minute. These are direct-connected to and driven by steam turbines. A 12x24-in. reciprocating plunger pump is also provided and held as a spare.

Feed-water regulators are used on all boilers, and automatic governors are provided for the turbines, maintaining a difference of pressure between pump and boilers of about 30 lb. This apparently large difference is probably necessitated, in part at least, by the interposition of the small number of economizers, through which the water for all the boilers must be forced in order to enter them.



EXTERNAL VIEW OF BOILER AND ENGINE HOUSE, SHOWING A PORTION OF THE LAWN

Regulating devices are also placed upon the engines driving the draft fans. By these means a boiler pressure of 150 lb. is maintained at practically a constant value.

The feed water used is drawn from the hot well of a surface condenser. It passes first into a 6000-hp. Cochrane feed-water heater, which it enters at a temperature of from 60 to 100° F., varying according to the season of the year and the conditions of operation. The water leaves the heater at a temperature slightly in excess of 200° F., passes through the pump, and enters the economizers. It normally leaves the latter at a temperature of about 240° F.

It should be borne in mind in connection with this latter temperature of the water that the supply for all of the boilers is forced through the economizers, which are subjected only to the gases from the Babcock and Wilcox boilers. This adequately accounts for the comparatively low final temperature of the water.

By means of a venturi meter all the water entering the boilers is measured and permanent records of its amount kept.

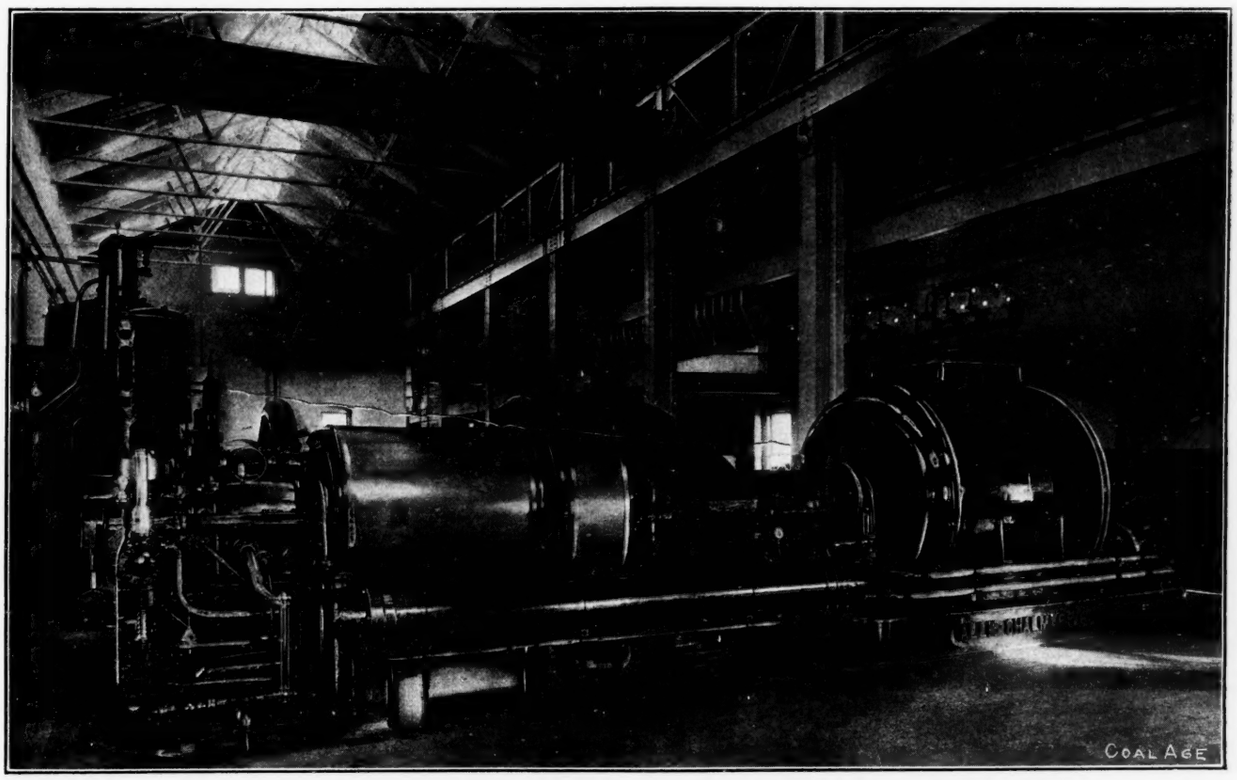
Four steam lines, ranging from 8 in. to 12 in. in diameter, and from 1200 ft. to 3800 ft. in length, radiate from the boiler house to the various collieries supplied from it. A double steam line also leads to the power plant. A Dodge steam-flow meter is installed in the boiler-house office, and connected to each of these lines in such a way that the quantity of steam in any of them may be continuously measured.

All of these steam lines are extra heavy, including all fittings and bends. In the lines which have been installed more recently, 40-ft. lengths of wrought-steel pipe have been employed, which are provided with Vanstone joints. These pipelines are carried upon supports composed of old steel T-rails. All are carefully covered and painted. The water piping, with the exception of the necessary expansion joints, is extra heavy cast iron.

The Generating Equipment

At this plant the generating units are located in a building distinct from the boiler house. The two are separated by a distance short enough to be convenient, but long enough to avoid the dust and dirt existing in the boiler room.

The power house proper contains five vertical, Curtis turbo-generators of 500 kw. capacity each, operating at a voltage of 2300 and a frequency of 60 cycles. There are also two Allis-Chalmers 2000-kw., 2300-volt, 60-cycle, horizontal turbo-generators in the same room. Four of the vertical turbines and the two horizontal machines use barometric condensers. The other turbine exhausts into a surface condenser.



Another View of Power-house Interior, Showing Horizontal Turbines, Traveling Crane, Etc.

Mine water is employed for cooling purposes in the former machines, and as this is strongly acid, all pipes, as well as the condensers themselves, are wood-lined. In the surface condenser fresh water is used, which is then fed to the boiler plant.

The five Curtis turbines have two dry vacuum pumps so connected to the condensers as to be available for either or all of these machines. Each of the 2000-kw. turbines has its own dry vacuum pump, but these are cross-connected, so that either pump will serve either turbine, or rather its condenser.

The large machines are also provided with home-made automatic vacuum breakers to prevent water from backing up into the machines, should the condensing equipment by any mischance be flooded.

One engine-driven exciter is provided for starting up

and for emergency, while a motor generator set is employed for ordinary or continuous excitation.

A 10-ton electric crane spans the main part of the building, and serves all machines both on the main floor and basement (where the dry vacuum and condenser circulating pumps are located), except the outboard bearings of the large units. For these a smaller crane is provided.

The switchboard is located on the main engine-room floor, and is both compact and convenient. Transmission is accomplished at 2300 volts in all lines except that to the D. L. & W. shops, where 4600 volts are employed.

This plant is frequently called upon to develop 12,000 hp. It supplies current to 15 mines for lights, locomotives, pumps, rock crushers, breakers, drag lines, etc. It also furnishes current to a water shaft and approximately 1000 kw. to the D. L. & W. shops, yards, offices, etc.

The Pleasant Surroundings

It requires more than good equipment to make an efficient plant. The human element enters into power generation to a degree not ordinarily recognized by coal operators. To obtain satisfactory results, not only must the equipment be of the best, but good morale must exist within the operating organization.

Much has been done around this plant to render pleasant the environment of the men employed. Most conspicuous are the well kept lawns and flower beds, with which the buildings are surrounded. Of course, grass and flowers have no direct connection with the combustion of fuel or the generation of energy, but a little care and pains expended upon the grounds around almost any power station is practically certain to find a reflection in the increased care and pride the workmen take in the daily operation of the machinery intrusted to their keeping.

Hydraulic Stowage in Westphalia

From a British consular report it appears that hydraulic stowage of wastes in Westphalian coal mines is increasing from year to year, and that in the near future the majority of the coal mines may be compelled to adopt this system. In the old days the plan was to produce as much coal as possible at the least expense. In recent years, however, surface damages and claims for compensation are getting more frequent as the value of coal land rises. As a result, a system of hydraulic stowing has been adopted to support the surface, prevent buildings from cracking and railways from subsiding.

The ideal material is sand. In Westphalia this is not available. Instead a mixture of pit waste, blast-furnace slag and ashes is ground down and well mixed, and then flushed down the pipes with water. In many instances the pillars of coal which formerly had to be left to support railways and buildings have been dispensed with. In fact, there are places where the coal is being worked from under the town by this system with no dangerous results.

The pipes used for hydraulic stowing are items of considerable expense. They consist of an outer shell of steel or wrought iron with a cast-iron lining. The diameter is usually about 7 in.

Where sand can be used hydraulic stowage is cheap and is said not to amount to more than 12c. per ton, but in cases where more expensive material has to be mixed and ground down before use the cost of stowage rises to 24c. per ton of coal. It is maintained that with hydraulic stowage the expenses for pit-timber are reduced and the total coal output per annum increased.

Song of the Coal Miner

(Written expressly for Coal Age.)

By Berton Braley

Down in the hole where it's dark as pitch,
An' wetter'n we care to say,
We cut an' shoot to make 'em rich—
The fellers that pay our pay;
They drops us down in a rattlin' cage
A thousand feet er so,
An' there we work in the dust an' murk
Makin' the profits grow.

What if we do "take five"*
What if we do "take ten"*
The men that didn't ain't alive,
They're part uv the "might-uv-been."
We aim to do what's fair,
We think we do what's right,
But we'd rather be LIVE lazy men
Then under a tombstone white.

We gotta look out when the "cap" turns blue,
We gotta "shoot down the back,"
'Er while we're drillin' a hole er two
The roof uv the room may crack,
An' then it's "Dig the poor devil out
An' take him up to the top."
Fer the wife may sigh an' the children cry,
But the Mine—the Mine can't stop.

Down in the deep black hole
There's allus the chance to take,
Uv a "missed hole" found er a "fall uv ground"
Er a ladder that will break.
So what if we do "take five"
An' what if we do "take ten,"
We'd rather be lazy an' alive
Than dead as we "might-uv-been."

We puts in timbers an' takes 'em out
In crosscut, entry er raise;
Soldierin' sometimes, there's no doubt
But them is natural ways.
We takes our lives in our hands each shift
For never a guy can tell,
But what he will pick in a powder stick
That'll blow him all to hell.

So what if we do "take five"
An' what if we do "take ten,"
We're here today, alive,
Not part uv the "might-uv-been."
There's better men than us
That tried to outwork a mule,
But we'd rather be LIVE in a coal mine here
Than dead in a graveyard cool.

*"To take five" or "take ten" means to rest for five or ten minutes.

Barometric Condenser Installation

SYNOPSIS—In the barometric condenser, the condensing water and condensate flow out of the cooling chamber without being pumped. A vacuum of 25 in. can be obtained without the use of an air pump as the air is entrained by the falling water in the condenser, but a pump must be used if as complete a vacuum as 28 in. is desired. Too much water should not be used in high-vacuum work or the condenser will be choked and the air and water to be handled will be increased without corresponding advantage.

One of the largest mining central stations in this country is located at Homer City, Indiana County, Penn., about 45 miles from Pittsburgh. The power station is one of a number of plants throughout western Pennsylvania, owned and operated by the Rochester & Pittsburg Coal & Iron Co., and is a fair example of the modern tendency of generating power at one mine and distributing it through high-tension lines to other operations.

Convenience for Obtaining Coal Locates Plant

In building the plant, due consideration was given to alternative locations. The installation could be placed near the coal supply or convenient to water. As it was necessary to install pumps for the cooling water, regardless of the site chosen, and a pipeline was the only additional equipment rendered necessary by a choice of a location convenient to the coal supply, the plant was located at the mine shaft. This greatly reduced the cost of handling the coal. The loaded cars, on being brought to the ground level, are run directly into the boiler room and emptied into the coal bunkers.

Description of Power Plant

The power house is built of brick with concrete foundation and occupies a space of 100x150 ft. It is an imposing building and the twelve steel stacks and three condenser exhausts can be seen for miles.

The prime movers consist of two General Electric Co. 3000-kw. horizontal turbo-generators, and an Ingersoll-Rand two-stage air compressor. Space has been reserved for a third turbo-generator of 3000 kw. The exhaust of the two turbines is condensed by two Wheeler barometric condensers, with 48-in. exhaust elbows, vacuum

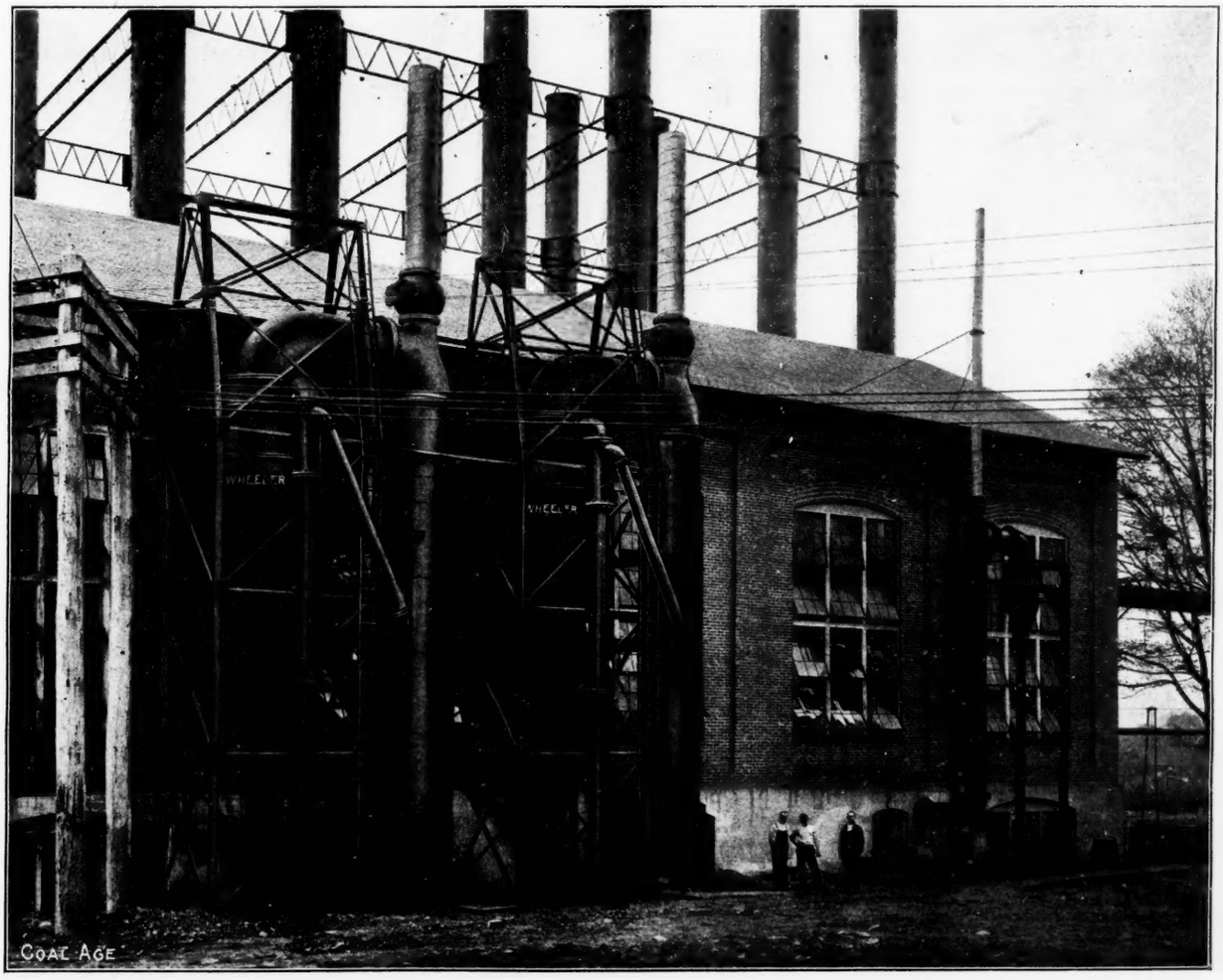


Fig. 1. Three Wheeler Condensers at the Luzerne Plant of the Rochester & Pittsburgh Coal & Iron Co., at Homer City, Penn. The Large Outfits on the Left Condense Steam from Two Turbines; that on the Right Forms the Vacuum for the Steam End of an Air Compressor

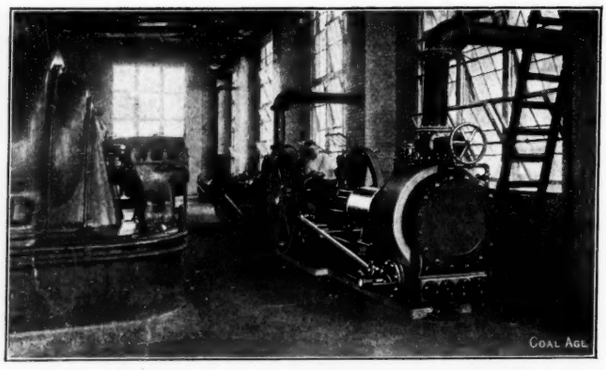


FIG. 2. A DRY-VACUUM PUMP REMOVING AIR FROM THE EXHAUST STEAM AND THE CONDENSING WATER

breakers and 24-in. automatic exhaust relief valves. The two large turbine condensers may be seen at the left in Fig. 1.

A Wheeler rotative dry-vacuum pump of the tandem type removes the air and uncondensed gases from each condenser, even with high cooling-water temperature. The exhaust piping is of riveted steel, which is quite unsuitable for high-vacuum service and it is probable that if this could have been kept perfectly air-tight, unusual results might have been obtained.

EXCESSIVE USE OF WATER IN BAROMETRIC CONDENSING

However detrimental this leakage was to the maintenance of a high vacuum, the loss was undoubtedly small compared to that resulting from the undue excess of injection water which was fed to the condensers at all times. Barometric condensers will not operate at their best with more than a minimum amount of water, yet in nearly every case where the initial operation of the condenser has been left to the engineer of a plant, the mistake has been made of using too much water, with the result that the throat of the condenser is constantly choked.

Formerly, for engine work and reasonably cold water, the amount of injection water used was rarely considered. But with large high-vacuum condensers for warm water, the quantity used is very important; first, because of the cost of pumping and second, on account of the quantity of air to be handled, a large part of which comes from the cooling water.

WORK OF CONDENSERS ROCHESTER AND PITTSBURGH COAL AND IRON CO.

	Unit No. 1		May 25, 1911				Unit No. 2		May 27,1911			
Time	Temperature of Cooling Water F	Temperature of Discharge F.	Load in Kilowatts	Vacuum Observed Inches of Mercury	Barometer Inches of Mercury	Vacuum Corrected Inches of Mercury	Temperature of Cooling Water F.	Temperature of Discharge F.	Load in Kilowatts	Vacuum Observed Inches of Mercury	Barometer Inches of Mercury	Vacuum Corrected Inches of Mercury
9:00	76	84	1800	27.25	29.08	28.17	73	84	1200	27.15	28.98	28.17
9:30	77	84	1750	27.20	29.08	28.12	74	84	1250	26.08	28.98	27.92
10:00	77	84	1750	27.25	29.08	28.17	74	84	1300	27.10	28.98	28.12
10:30	78	87	1800	27.20	29.08	28.12	74	84	1150	27.10	28.98	28.12
11:00	78	87	1800	27.20	29.08	28.12	74	84	1200	27.12	28.98	28.14
12:00	78	87	1600	27.15	29.08	28.07	74	84	1250	27.12	28.98	28.14
1:30	78.5	86.5	1950	27.00	29.08	27.92	74.5	84	1200	27.10	28.98	28.12
2:00	80	86	1650	27.15	29.08	28.07	74	84	1300	27.15	28.98	28.17
2:30	80	86.5	1850	27.10	29.08	28.02	74	83.5	1250	27.10	28.98	28.12
3:00	81	87	1700	27.15	29.08	28.07	74	83.5	1200	27.10	28.98	28.12
3:30	81	86.5	2000	27.25	29.08	28.17	74	85	1350	27.05	28.98	28.07
4:00	80	86	1950	27.25	29.08	28.17	74	85	1200	27.10	28.98	28.12
Average	78.7	85.9	1800	27.18	29.08	28.10	74	84.1	1238	27.09	28.98	28.11

condenser. This may be seen in Fig. 2. At the bottom of the exhaust pipe, near each turbine, a 5½x8x7-in. direct-acting suction valveless hotwell pump and hotwell, handles the condensate not carried by the exhaust into the condenser.

A 28-INCH VACUUM OBTAINED

Each outfit was designed for 54,000 lb. of steam per hour and to give a vacuum of 28 in. using 4340 gal. of water per min. at 70 deg. F. With 25 per cent. less water and without the air pump, the same amount of steam can be handled and a 26-in. vacuum provided. The official test proved that a much better vacuum than this could be continuously maintained.

A Wheeler condenser with elbow, vacuum breaker, 10-in. relief valve, 7x16x14-in. tandem rotative dry-vacuum pump, and 5½x8x7-in. hotwell pump, furnishes vacuum to the air compressor. This unit is designed for 10,000-lb. steam, a 27-in. vacuum receiving water at 70 deg. F., and may be seen at the extreme right of Fig. 1.

Two motor-driven DeLaval pumps of 5000-gal.-per-min. capacity are installed at the cooling-water supply, which is about 1200 ft. from the plant.

In order to start up the condensers one of the main turbines must be run noncondensing for a time to furnish power to the pumps.

The table gives a number of test readings on units Nos. 1 and 2. A glance at the vacuum readings shows what favorable results may be obtained from this type of

THE OPERATION OF THE CONDENSER

Fig. 3 is a sectional view of the Wheeler barometric condenser, showing the water distribution and how the steam and water are mingled. The condenser is a pear-shaped shell with a large opening at the top for exhaust steam and an opening at the side for cooling water, while at the bottom connection is made to the barometric column which discharges the water to the atmosphere without a tail pump.

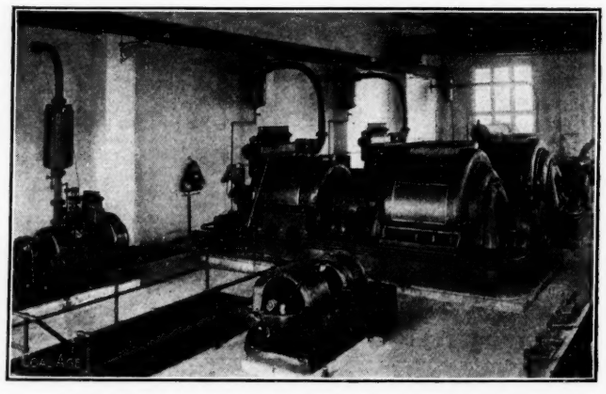


FIG. 3. INTERIOR OF THE LUZERNE POWER HOUSE, SHOWING TURBO-GENERATORS AND TURBO-EXCITERS

The water entering near the top flows into the annular reservoir with vertical slots in its inner wall, through which the water falls in a large number of streams in the direct path of the steam, causing partial condensation and heating of the water. The water is then collected upon the tray immediately beneath, from which it splashes upward to some extent, causing further condensation, and heating of the water. Finally the stream flows through the multitude of small holes in this collecting tray, falling in a rain to the bottom of the condenser, and condensing the remainder of the steam.

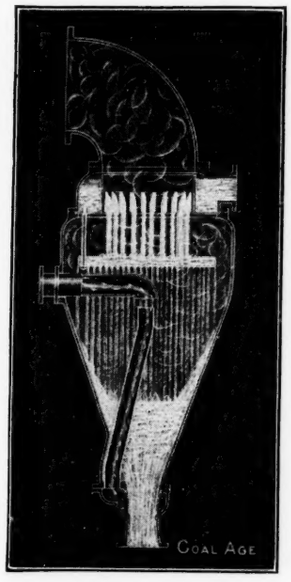


FIG. 4. SECTION SHOWING CONDENSER AT WORK, EJECTING AIR AND CONDENSING STEAM

CONDENSER ITSELF EJECTS AIR FROM "VACUUM"

For high-vacuum work the air is withdrawn by a vacuum pump (see Fig. 2) which is connected to the air-outlet nozzle at the left center of Fig. 4. The arrangement of the air intake within the condenser may be plainly seen.

For moderate vacuums an air pump is unnecessary, since the water falling down the condenser shell entraps air and carries it out by ejector action. Air is also supplied to the neck of the ejector by the air pipe shown.

Several times during the initial run of the outfits at Homer City, the condensers were operated without the air pumps and in all cases, fair working vacuums of 25 in. and 26 in. were recorded. The average vacuum obtained is 27.75 in., which corrected, is 28.75 inches.

Low Pressure Turbines

The term "low-pressure turbine" refers to machines which utilize exhaust steam at about atmospheric pressure by expanding it to a lower pressure maintained by means of a condenser.

The only costs chargeable against the low-pressure turbine are interest depreciation and maintenance of the turbine and condensing apparatus. They, therefore, furnish the most economical method of increasing plant capacity where the main engines are operated noncondensing, or, for furnishing power for live rolls or lighting in rolling mills and mines where exhaust steam from rolling mill or hoisting engines is available.

Where the exhaust steam from a single engine running intermittently, such as in hoisting, is to be used for operating a low-pressure turbine, continuous operation of the latter is made possible by use of a steam regenerator, or heat-storage reservoir which consists of a plain cylindrical tank partly filled with water, which condenses the excess exhaust steam not used by the turbine when the engine is running, and reëvaporates it, owing to a slight drop in pressure in the regenerator when the supply of engine steam is deficient.

In large plants having a number of noncondensing engines, the installation of a central low-pressure turbine plant with the exhaust lines from the isolated engines, all discharging into a single header in the station, the average flow will be sufficiently uniform so that the heat storage in the exhaust mains may be adequate, thus rendering a regenerator unnecessary.

When sufficient exhaust steam is constantly available for operating the low-pressure turbine, the simple design without a governor is preferable.

A New Mechanical Stoker

The Sanford Riley Stoker Co., Ltd., Worcester, Mass., is placing on the market a new automatic stoker which, in many ways, is an improvement over all its predecessors. It is of the underfeed type, with self-dumping features, and is the only underfeed stoker that has such a mechanical movement of the fuel-bearing surfaces, that the movement of the fuel and ash down the slight incline results in a continuous rather than a periodic cleaning.

For a year the Riley stoker has been tested out in a large electric-light plant, with conspicuous success. It has been operated under the severest conditions of actual service, and has been subjected to numerous tests to determine its efficiency and capacity. As a result of these tests, final improvements have been introduced and parts standardized.

Like all other underfeed stokers, the Riley is smokeless, even when forced to far beyond the normal capacity of the boiler. Unlike other types, however, it is without dead plates, the entire surface within the furnace being live fire surface. The makers claim that this stoker takes up less room than other types. It has been made thoroughly rugged in every part, but at the same time protected by shearing pins, so that serious obstruction in the fuel can cause no damage to the mechanism.

West Virginia Examinations

There were 41 persons who were successful in passing the state examination for mine foreman and firebosses, held at Clarksburg, W. Va., Dec. 17 and 18, 1912. The names of the successful candidates are as follows:

First grade—Elkin Reed, Simpson; O. C. Straight, Clarksburg; Roscoe Summers, Gypsy; John M. Matheney, Mt. Clare; L. K. Richard, Lewis; Jno. Oldroyd, Clarksburg; Scott Sturm, Worthington; James Cummings, Reynoldsville; S. D. Conner, Gypsy; Jno. A. Rutter, Gypsy; Clyde Van Pelt, Wilsonburg.

Second grade—Homer Yates, Grafton; M. L. Gett, Enterprise; W. H. Folf, Hutchinson; P. J. Smallridge, Weaver; Jesse M. Lutman, Forbes Road; Linnie H. Harvey, Clarksburg; Thomas McCormick, Clarksburg; Marvin S. Miller, Fairmont; Frank Trader, Everson; P. O. Satterfield, Hutchinson; J. B. McCloud, Gypsy; J. H. Yoder, Shinnston; Howard Conner, Clarksburg; J. W. Bernard, Clarksburg; Allen Watson, Monongah; Richard Adcock, Reynoldsville; Guy Russell, Interstate; A. J. Powell, O'Neil; John Charry, Viropa; Ira Ernest Bales, Barrackville; John J. McElroy, Fairmont; J. B. Greynolds, Raynesville; E. W. Freeman, Enterprise; Dave Malone, Morgantown; W. D. Walker, Blaine; Thomas L. Price, Mt. Clare; Peter McCormick, Clarksburg; H. C. Saunders, Everson.

Firebosses—Wm. Leeper, Farmington; Matthew Conners, Grant Town.

Lignites may be profitably used in: (1) Gas producers. (2) Specially constructed boilers. (3) Briquettes. The U. S. Reclamation Service has a boiler at Williston, N. D., which burns lignite untreated, shortly after it is taken from the mine. When lignite is to be used for briquetting it should be thoroughly crushed, then dried until it contains not more than from 5 to 10 per cent. of moisture, then compressed while still warm.

Central Station of Clinchfield Company

By W. H. Easton*

SYNOPSIS—The Clinchfield Coal Corporation, of Dante, Va., has gone through the evolutionary process common to many large coal producers. The company has abandoned its small power plants and replaced them by one central station and five substations, some of which are situated over eight miles from the point at which the power is produced. Thus the water problem has been met and the cost of generation and transmission reduced. The business of producing power and of extracting coal are thus kept distinct and both are in charge of men best fitted to handle them.

The mines of the Clinchfield Coal Corporation, with headquarters at Dante, Va., are interesting for many reasons but are especially noteworthy because of their system of developing and transmitting power.

In starting the earlier development, each operation had its own power plant which was situated as advantageously as possible to the water supply. These plants supplied direct current and operated with as high an efficiency as is possible for this type of installation.

Replacement of Scattered Units by Central Power Plant

The management never questioned the advantages of the use of electricity. The superiority of electric power for operating locomotives, pumps, fans, hoists and other mine machinery was regarded as sufficiently demonstrated. When, however, the development work was well under way and broader plans were formulated for the company, it became evident that great economy could be secured by doing away with the isolated power plants, efficient as they were as compared with ordinary steam plants, and operating all the company's mines from one central power station.

One of the most important considerations that led to the change was the question of water supply. Fig. 1 shows the character of the country in which the company's operations are located. It is typical coal country, where, as every miner knows, the water supply is usually not satisfactory. The rains drain off very rapidly and the rivers vacillate between conditions of flood and low water. Moreover, as much of the coal first developed lay high in the hills, it was difficult to locate the power houses immediately adjacent to the operations, which is necessary in order to secure good economy with a direct-current plant.

The Advantages of Having Only One Plant Which Can Be Placed in Charge of Competent Men

Another consideration of great importance was that of greater reliability. At a central power plant there is nothing to be done but to keep power on the lines. At the mines all thought of power is eliminated; there is nothing to interfere with the getting out of coal. Consequently, there is practically no loss of time because of the failure of the power, and the coal-mining operations can be carried on with greater effectiveness. The result is greater and cheaper production.

*Pittsburgh, Penn.

Proper boiler water was also hard to obtain at some of the mines, and bad boiler water meant heavy repair expenses and, what is even more serious, occasional shutdowns. In fact, all maintenance expenses could be greatly reduced by centralizing the power supply, as all machinery can be given better attention and kept constantly in the best operating shape.

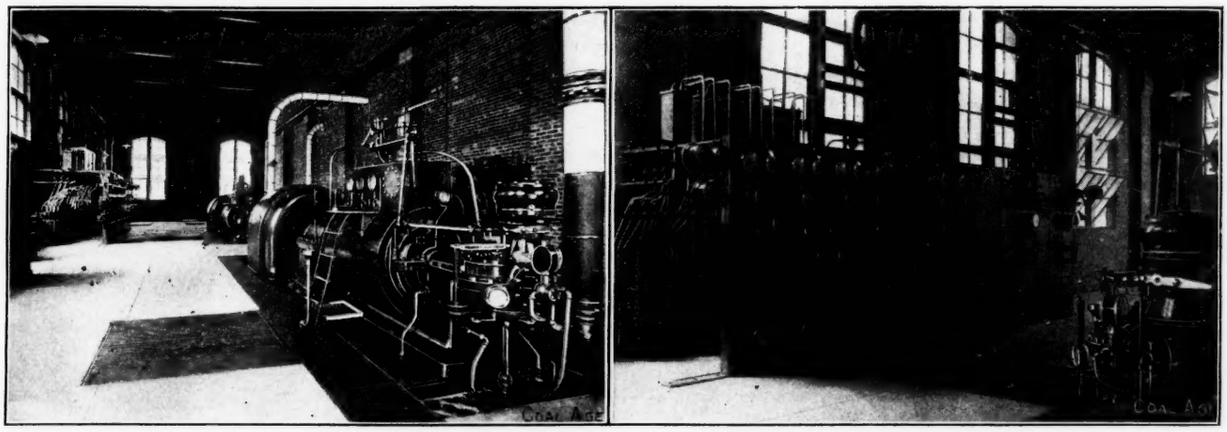
For these reasons, the Clinchfield corporation established a central power station at Slemp, Va., on Dumps Creek. The generating equipment consists of two 1250-

Fig. 1. View, Typical of the Country in Which the Clinchfield Coal Corporation Is Operating. Inclined Plane of One of the Laurel Mines in Foreground

kv.-a. Westinghouse turbo-generators, which develop three-phase, 60-cycle power at 6600 volts and have an overload capacity of 1560 kv.-a. each. Fig. 2 shows the interior of this plant. Fig. 3 shows the switchboard.

Substations at Slemp, Laurel and Dante

The power is transmitted at present to five substations, one near the power house at Slemp, one at Laurel, some three miles distant, and the other three are located on the Dante group of operations, eight miles away. Thus all the power required for the Dante and Laurel operations is supplied from a single power house. The addition of two more substations is contemplated and the apparatus for them was included in the original contract with the Westinghouse Electric & Manufacturing Co.



FIGS. 2 AND 3. CENTRAL POWER PLANT OF CLINCHFIELD COAL CORPORATION, AT SLEMP, VA. FIG. 2 SHOWS TWO WESTINGHOUSE TURBO-GENERATORS, 1250 KV.-A, 6600 VOLT, 3 PHASE, 60 CYCLE. FIG. 3. ILLUSTRATES THE SWITCHBOARD

This scheme of power distribution lends itself readily to expansion and it is probable that the future development will justify the addition of a 2000- or 3000-kv.-a. unit for distribution at either 6600 volts or some higher voltage, such as 23,000 or 33,000. This higher voltage will enable power to be transmitted economically to more remote Clinchfield properties as they are developed for an increased tonnage.

The substations are comparatively simple installations. Fig. 4 shows the end of the Laurel substation, Fig. 5 the exterior. They can be placed almost anywhere and are independent of water. The main feature of their equipment is a motor-generator set, the one at Slemp being shown clearly in Fig. 6.

Each set consists of a 6600-volt alternating-current Westinghouse motor which drives a 300-hp. Westinghouse generator delivering direct current at 275 volts. Thus the high-voltage alternating current transmitted from the power house is transformed into low-voltage direct current, suitable for driving locomotives, pumps, fan motors, lights, etc., at the mine.

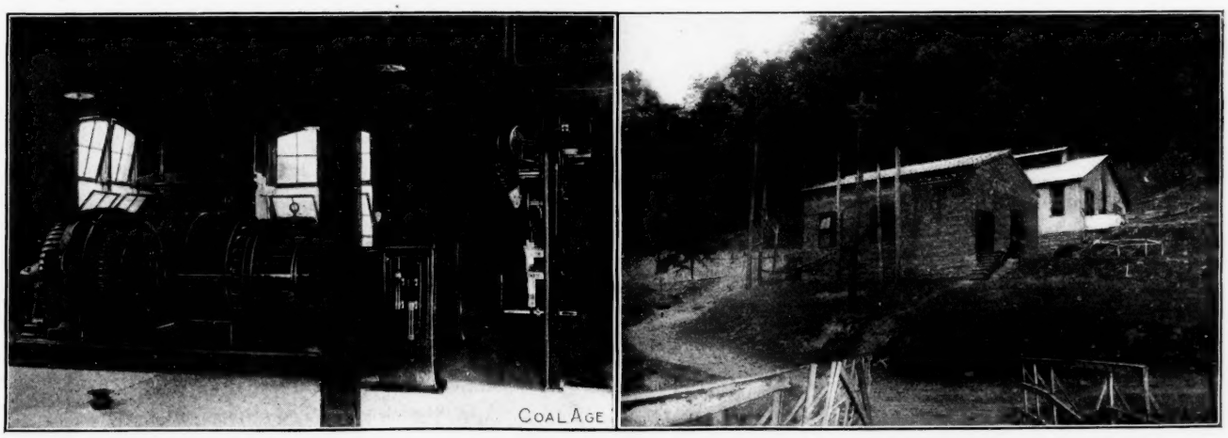
The substation requires little attention. The motor-generator set runs practically continuously and an attendant is needed only to see if everything is running properly. If power is not wanted the motor is stopped and all expense for current ceases; starting up is simply a matter of throwing a switch and full power is immediately available.

THE ADVANTAGES OF PURCHASED POWER

This system of power distribution is unquestionably the most advantageous for companies in the position of the Clinchfield corporation. Companies operating single or widely separated mines can secure its most important advantages by purchasing power from power-supply companies if such are operating in the vicinity.

It is often difficult for a mine operator to see that he can in many cases actually buy power cheaper than he can make it himself when apparently he is getting his fuel for nothing. But his fuel should be figured at the cost which it would bring if sold.

Furthermore, while he is making his own power, his attention is centered on the power house because trouble there means shutdowns and loss of production; but with central-station power, he transfers this responsibility to those whose whole business it is to carry it, leaving him to the uninterrupted business of mining coal. Records go to prove that central-station power is more reliable than that from private plants. The operator substitutes his power house with its engineers and firemen and its need for good and abundant water, for a small substation that requires minimum attendance and no water supply.



FIGS. 4 AND 5. INTERIOR AND EXTERIOR OF LAUREL SUBSTATION OF THE CLINCHFIELD COAL CORPORATION

He can shut down his plant with little expense and start up instantly, as far as power is concerned. He can obtain increased power quickly and at less cost than is involved in building additions to his power plant. His power is at all times ample so that production does not lag. If his operations become so extensive that the voltage drop in the direct-current lines becomes too great, he

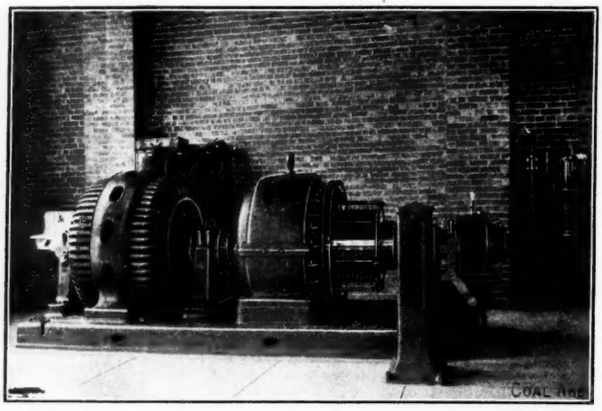


FIG. 6. WESTINGHOUSE MOTOR-GENERATOR AT SLEMP SUBSTATION, 300 KW., 275 VOLT, D. C. GENERATOR, DRIVEN BY 6600-VOLT SYNCHRONOUS MOTOR

is easily able to run high-tension lines to the proper points and install other substations, in the mine if need be.

In any case, it is well worth while for every mine situated to obtain centralized power to estimate its present costs and those of operation with purchased power, thus obtaining assurance that it is on the most economical basis possible.

An Automatic Feed Regulator in Coal Cutting

It is admittedly true that the coal cutter is a difficult portion of electrical mine equipment to keep in proper repair. This is due to the hard work which it has to perform, and frequently to the class of attendant in whose care it is placed.

The ordinary machine runner is more concerned with the amount of coal secured than with technical considerations as to overloads on electrical equipment. Hence the coal cutter is not infrequently worked at a rate which imposes, even under normal cutting conditions, a severe test as to its continuous reliability.

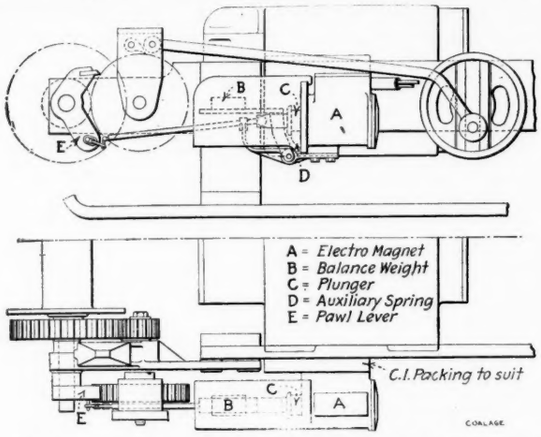
When, in addition to this, it is remembered that it is the rule rather than the exception to find the face varying as regards the nature of the material to be cut, it is evident that a very serious additional strain is thrown on the cutter from time to time, which, unless the speed of the cutting is regulated in accordance with the excess demand, is very liable to work serious results.

The inevitable consequence is frequent and excessive overloads, which culminate in exasperating trouble, both electrical and mechanical. Under the severe conditions frequently met with, breakdowns and stoppages are numerous and the constant burning out of fuses or the tripping of cut-outs is annoying and sometimes positively dangerous.

It is interesting, therefore, to note that an automatic feed regulator has been successfully introduced by the British firm known as the Diamond Coal Cutter Co., of Wakefield. This contrivance is illustrated herewith. The regulator consists of an electro-magnetic device which, the moment that an excess of current is taken by the motor, stops the forward travel of the machine by lifting a pawl from its ratchet wheel. This does not stop the cutting action, but automatically adjusts the rate of travel to suit the conditions, allowing the cutter to advance the moment it has overcome the difficulty.

It will be seen that overloads, such as have been mentioned, may be caused by some extra hard material being met with in cutting, by the picks becoming blunt, by the men attempting to make the machine travel at too fast a speed, or by neglecting to use the shovel. Overloads due to any of these causes are automatically corrected if this feed regulator is employed.

In actual practice it has been found that under the most unfavorable conditions of working the armature breakdowns have been reduced by fully 70% and the output of the machine has been considerably increased, due to the longer total cutting time, resulting from the avoid-



DIRECT-CURRENT REGULATOR APPLIED TO DIAMOND MACHINE

ance of stoppages. Moreover, the gate-end fuses, which formerly blew frequently during every shift, were renewed only at intervals of several weeks.

The figure shows a direct-current regulator applied to a Diamond two-motor machine. The solenoid *A* is in series with the armature circuit, and at a predetermined current value draws in the plunger *C* against the weight *B* and the auxiliary spring *D*. The working current can be adjusted by moving *B* along the bar. When the plunger is drawn into the solenoid, the pawl attached to *E* is lifted and the machine ceases to travel forward until the current falls again to normal, when the plunger is released, the pawl once more drops into place and the machine is again put in motion.

For alternating-current machines the principle is the same, although the arrangement is slightly different. A shunt relay across one phase is employed, which interrupts the main circuit. The instrument is especially valuable for machines of this type, since the starting current involved brings the regulator into operation and allows the motor to start comparatively light.

It will readily be perceived, therefore, that a valuable addition has been made to this important portion of mine equipment.

Economy in Colliery Power Plants

By Sydney F. Walker*

SYNOPSIS—Description of a peculiarly effective electrical installation in Great Britain. Accumulators are used for storing the surplus power when running the electric plant under a light load, and by means of a novel arrangement, a similar conservation of steam is obtained. The plant presents a striking combination of the old and new.

With the increased cost of the working of collieries in the United Kingdom, owing partly to the increased depths of the seams, and largely to the greater cost of labor, colliery managers have found it necessary to look into all possible means of saving money. Owners in the United Kingdom are notoriously conservative; they move slowly in the adoption of a new plant, regardless of how large a saving it promises to effect, but when one pioneer has successfully carried out some improvement, every colliery of any standing generally follows suit. Thirty years ago, boilers at collieries generated steam at 30 lb. pressure; a little later they ventured to 50 lb., then to 80 lb., and now 150 lb. is quite common, while pressures of 200 lb., with water-tube boilers, may be found at many collieries. While the demand for steam is constantly increasing, and the boilers are at the same time gradually approaching the point where they have to be replaced, considerable economy is effected by doing away with the low-pressure type and installing others generating steam at 150 pounds.

There have been cases, however, where the low-pressure boilers were still in good condition, and where the management hardly felt justified in facing the expense of installing others of the higher-pressure type. The economy in a great many cases would hardly pay for the cost of making the change. One such case, on a large scale, was that of two collieries at Hucknall Torkard, in Nottinghamshire, England. These were about two miles apart, and each had its battery of boilers carrying steam at 30 lb. pressure. Those at the one colliery were dismantled, and the whole of the work at both plants is now performed by the one battery at the other colliery.

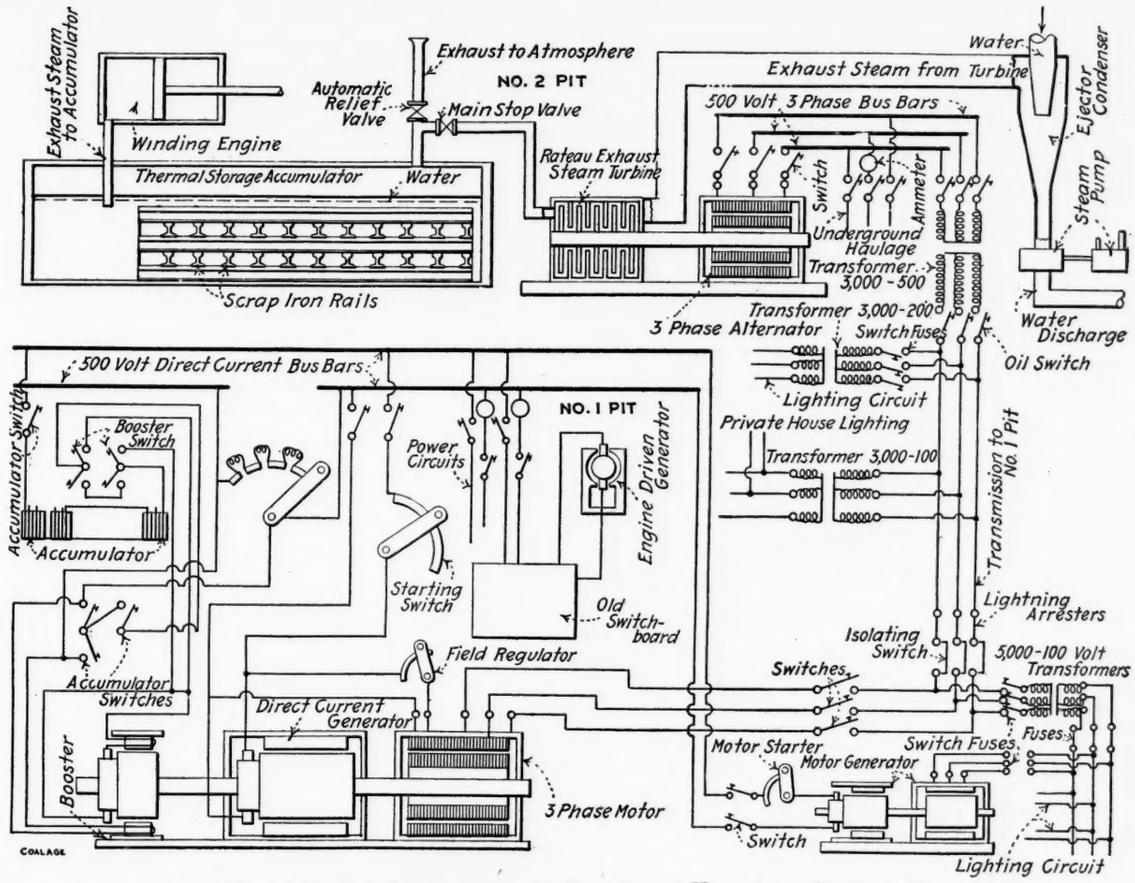


Fig. 1. General Plan, Showing Layout at Hucknall Collieries

Inefficiency of the Old Plants

In the early days, and up till quite recently, the steam used by the winding engine was considerable. Until 15 years ago, little thought was expended upon the steam consumption of the engines, at a colliery or, for the matter of that, at industrial works of any kind. The one thing needful was that the engine should work, and if more steam was required, more boilers had to be provided. With the increased cost of working the collieries referred to, the competition that has arisen in all industries, and perhaps more than all, with the general im-

*Bloomfield Crescent, Bath, England.

provement which has taken place in engineering work during the last 30 years, the question of steam consumption by engines came up for examination.

It will be remembered that feed pumps of boilers were found to be exceedingly wasteful, using the equivalent of 10, and sometimes 15 lb. of coal per horsepower-hour. As to the steam used by hoists, it was found that they were even more wasteful, 11 lb. of coal per horsepower-hour being quite a common consumption. And that did not tell the whole tale. The hoisting engine was frequently supplied by its own set of boilers, placed as close as possible to the engine house. As is well known, however, it only works for from 8 to 10 hr. a day, under the recent Eight Hours Act, with an occasional hoist for men, timber or supplies during the remaining 16 hours.

At the Hucknall collieries, what was previously a loss, has been turned into a source of economy. The exhaust steam from the engine is employed to supply a Rateau exhaust-steam turbine, which drives a three-phase generator. The current developed is employed for working the machinery at the colliery, and the whole of the plant, including the hoist at the other colliery, by the aid of currents transformed to 3000 volts, and transmitted on overhead wires from the one colliery to the other. There is a railway between the two collieries, and the pole transmission line, carrying three copper wires, insulated

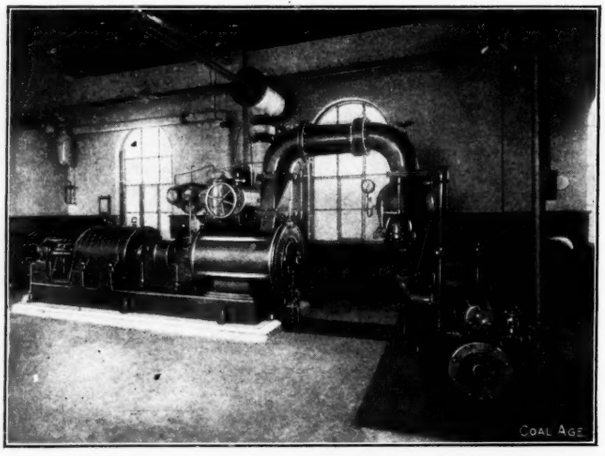


FIG. 2. THE EXHAUST TURBO-GENERATOR AND EJECTOR

with ordinary telegraph insulators, is fixed by the side of the road.

THE ARRANGEMENT OF THE POWER STATION

The installation is at what may be termed the power station, or the lower colliery, known as No. 2; the other mine is 1¼ miles up hill. There is, firstly, a thermal storage reservoir consisting of an old boiler, half filled with old iron rails, located outside of the engine house in which the turbine runs; the exhaust steam from the is about half full of water, the remainder of the steam is condensed to water, the boiler gradually becoming partially filled, and the old iron rails heated. When the boiler is about half full of water, the remainder of the steam is sometimes condensed to water, and sometimes merely delivered into the steam space between the water and the top of the boiler. It may be mentioned that the old iron boiler is merely a shell, and it is only exposed to a pressure of 2 lb. above the atmosphere or, say, 16.7 lb. absolute.

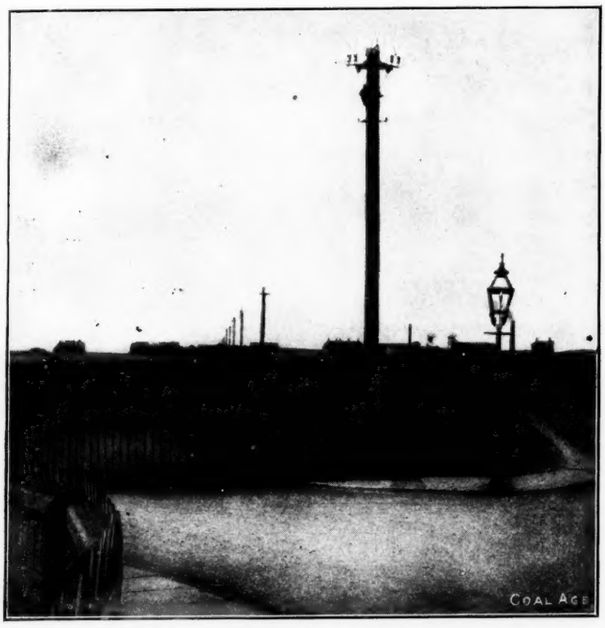


FIG. 3. EXTRA HEIGHT, THREE-PHASE TRANSMISSION LINE

The turbine takes steam from this old boiler, as long as there is any there to supply it, and when this fails, as when the hoist has been standing for some little time, live steam is fed to the turbine, through a reducing valve. Fig. 1 shows diagrammatically the arrangement of the thermal reservoir, the delivery of steam to it from the engine, from it to the turbine, and from the boiler to the turbine, when the supply of exhaust steam fails; it also shows the electrical system at the No. 2, and at the No. 1 pit.

When the engine is hoisting rapidly, and the quantity of steam going into the thermal reservoir is large, the storage capacity of the water and the old iron rails comes into play. The water is raised to a higher temperature, together with the old iron rails, while the pressure of the steam slightly increases. When the steam is not coming so fast, the rails, and the water, give up a portion of the heat which they have stored, and the pressure within the steam space being lowered, evaporation takes place on the surface of the water, steam being

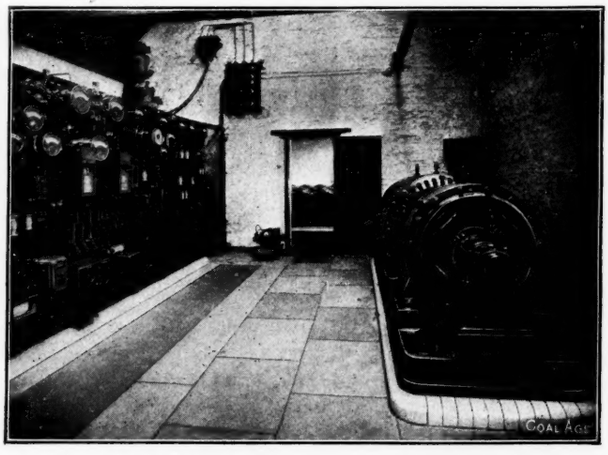


FIG. 4. VIEW OF SUBSTATION AT THE NO. 1 PIT

formed, and thus furnishing the supply required by the turbine.

The hoisting engine usually is shut down at about 11 p.m., the fires under the boilers being banked, and the turbine and turbo-generator also shut down. The current required for work during the night, at both collieries, and at the electric-light system, is supplied from a battery of electrical accumulators fixed at the other colliery.

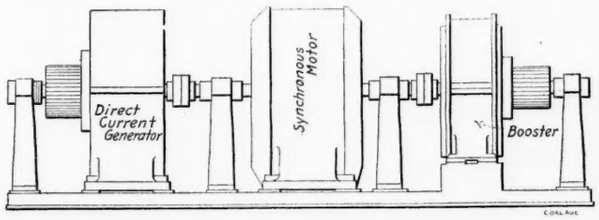


FIG. 5. MOTOR-GENERATOR AND BOOSTER AT NO. 1 PIT

THE ELECTRICAL SYSTEM

The arrangement of the electrical system is shown in Fig. 1. In the first place the steam turbine drives a three-phase turbo-alternator, furnishing current at 500 volts. Fig. 2 shows the turbo-engine house at the No. 2 pit, and Fig. 3 the overhead transmission line between the two pits. As mentioned before, the current at 500 volts is employed for lighting, pumping and haulage, at the mine where the turbine is fixed. For the power required at the upper colliery, where the boilers have been taken out, and where the only power is electricity, the 500-volt three-phase current is transformed to 3000 volts, three-phase, and carried by the transmission wires mentioned above, to the upper colliery. There the surplus energy, of the exhaust steam from the hoisting engine at the lower colliery, is stored in an electrical accumulator. It will be remembered that alternating currents cannot be employed to charge accumulators, and therefore the three-phase current has to be converted to continuous current, before the accumulators can be charged.

This is accomplished by the aid of what is called a synchronous three-phase motor, taking the 3000-volt system from the overhead transmission wires and converting it into mechanical power, the axle of the alternating-current motor being connected to the axle of a 500-volt continuous-current generator. The power from the continuous-current generator is employed to charge a storage battery fixed in a room close to the transformer house. Fig. 5 shows the arrangement of the motor generator and booster and Fig. 4 is a view of the substation in which the motor generator is housed, and of the accumulator house adjoining. But there was another problem to be solved. The continuous current from the motor generator is employed at the upper colliery for various work, such as driving mining machines, haulage, pumping, workshop motors of various kinds, together with electric lights for the surface, offices, etc. The cur-

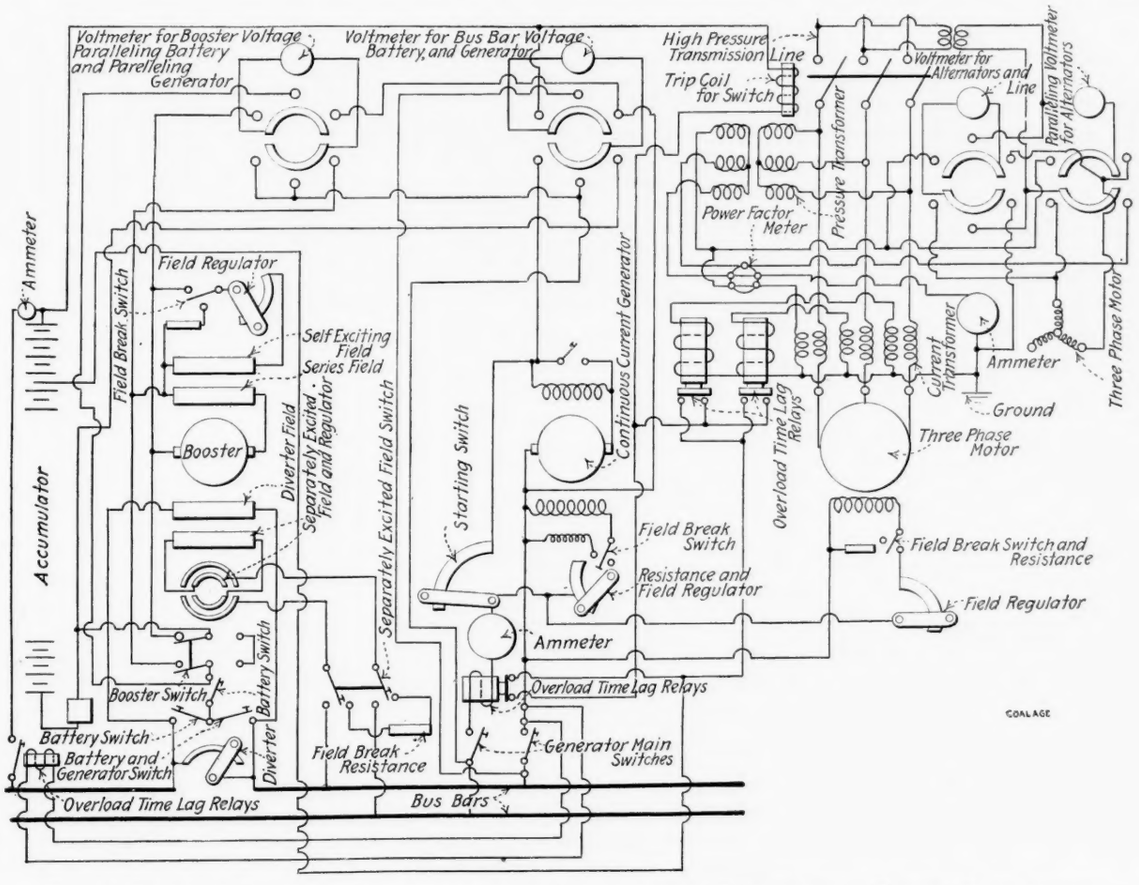


FIG. 6. DIAGRAM SHOWING ARRANGEMENT OF ACCUMULATOR, THREE-PHASE MOTOR, CONTINUOUS-CURRENT GENERATOR AND BOOSTER, WITH CONNECTIONS AND MEASURING INSTRUMENTS

rent from the generator side of the motor-generator is taken primarily to work the motors about the colliery, and any surplus energy that comes to the upper colliery from the thermal storage at the lower one, is stored in the electrical accumulator.

But, in all cases where there is a varying demand for energy, and where storage is attempted, there must be some arrangement for give and take. The thermal storage reservoir at the lower colliery, it will be remembered, takes up all the exhaust steam that is delivered to it, passing on the surplus energy to the overhead transmission wires. It also gives up stored energy when the exhaust steam is short.

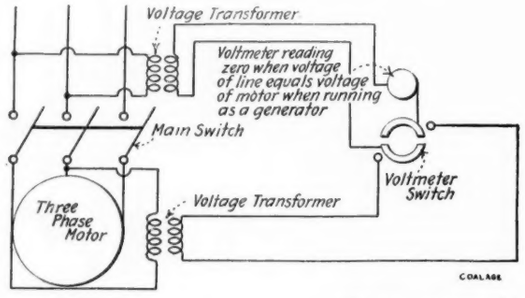

Voltage Transformer
Voltmeter reading zero when voltage of line equals voltage of motor when running as a generator
Main Switch
Voltmeter Switch
Three Phase Motor
Voltage Transformer
COALAGE

FIG. 7. METHOD OF CONNECTING THREE-PHASE MOTOR AT NIGHT

THE "REVERSIBLE BOOSTER" SYSTEM

In the electrical storage battery a similar arrangement holds. The problem at the upper colliery is similar to that at electric generating stations for small towns. No matter how carefully the number of engines and generators are regulated to the load, there was always some surplus energy wasted before the adoption of the method to be described. There were also always times when, unless the plant was running considerably over the average requirements, that there would be a shortage of power.

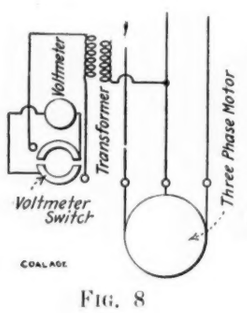


FIG. 8

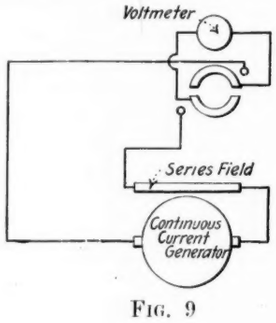


FIG. 9

What is called the "reversible booster" system met the difficulty. The "reversible booster" takes the surplus current from the generators, or rather from the "busbars," converts it to the pressure required for charging the accumulator, and on the other hand when the demand for current is above that which the generators running can supply, the "reversible booster" delivers the current required to make up the difference, from the accumulator, re-converting it to the "busbar" pressure in the process.

A little explanation again is here necessary. When charging electrical accumulators, a pressure of about 30 per cent. above that which the accumulator itself will deliver when discharging, is required. The individual lead accumulator cell furnishes, when discharging, a pressure of from two volts downward, the pressure decreasing as the discharge proceeds. While being charged, gases are generated by electrolysis, in the dilute sulphuric acid in which the lead plates are immersed, and the presence of these gases increases the pressure between the plates of the accumulator to 2½ volts per cell. In addition, each accumulator offers a certain electrical resistance to the passage of the charging current.

When a current is passed through the accumulators to charge them, it must be of sufficient pressure to overcome this back pressure, which the accumulator itself is furnishing, and also to overcome the resistance of each individual cell. This leads to the 30 per cent. or so, increased pressure required by the charging current. If an accumulator is charged, and allowed to stand for a few minutes after the charging current is cut off, it commences to deliver current at about 2 volts. When, however, current is taken from it during the process of charging, it would be at the pressure of 2½ volts, and therefore would be unsuitable for performing the work that is being done by the current delivered by the generators themselves.

The difficulty is met by the "reversible booster" reconverting the 2½ volts to 2 volts, and delivering it at that pressure to the busbars. The accumulator then acts as another generator connected in parallel with those running. In practice, there is a variable see-saw between the accumulator and the generators. At certain times of the day the accumulators are receiving a large quantity of current, and at others they are receiving only a little; again at times they are discharging small quantities, but at others, when lighting and power are required together, comparatively heavy discharges are taken from the accumulator.

SYSTEM AT THE HUCKNALL COLLIERIES

At the Hucknall collieries, a reversible booster is fixed with its axle forming part of a mechanical system in which are arranged the synchronous motor and the continuous-current generator. Fig. 5 shows this, and Fig. 6 the arrangement for charging the accumulators.

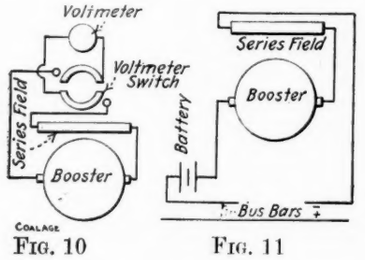


FIG. 10

FIG. 11

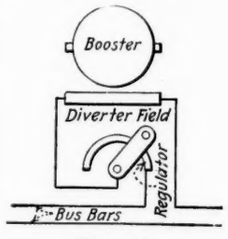


FIG. 12

All surplus steam, up to a certain point, is converted, at the lower colliery, into electricity, and transmitted to the upper colliery. This electricity furnishes all the power that is required at the upper colliery and any surplus that remains is delivered to the accumulator. The accumulator itself helps to make up any deficiency of power at the lower colliery. It was mentioned above, that the boiler and hoisting engine at the lower colliery is shut down at about 11 p.m. and a certain amount of power was required after that time. After the boiler and hoisting engine are shut down at the lower colliery, the

current from the accumulators at the upper colliery is transmitted to the lower one, being first transformed through the motor generator, and through the reversible booster, into three-phase alternating currents at 3000 volts.

It will be remembered that every continuous-current generator also acts as a motor, if required, and a synchronous alternating-current motor will act as a generator if required; consequently when current is no longer coming from the lower colliery to the synchronous motor, power is delivered from the electrical accumulator to the continuous-current generator, driving it as a motor, assisted by the reversible booster. The synchronous motor then becomes a three-phase generator, and delivers an alternating current at 3000 volts to the overhead transmission line. At the lower colliery, the 3000-volt, three-phase currents are transformed down to the 500 volts at which the colliery service is worked. The lights for the houses are supplied by special transformers, arranged for the purpose, furnishing current at 100 volts. These lighting transformers take power from the three-phase generator at the lower colliery while it is running, and from the synchronous motor, working as a generator, at the upper colliery, when the generator at the lower one is standing. Figs. 7 to 16 are parts of the diagram given in Fig. 6. They represent the details of the arrangement.

The Haulage System at the Lower Colliery

The working of the haulage system at the lower colliery, where the exhaust-steam turbo-electrical generating station is, will probably be interesting, inasmuch as it is a conversion from a steam drive to an electric. The colliery where the plant is installed is an old one, having been working something like half a century. The haulage underground is worked by two endless ropes, which

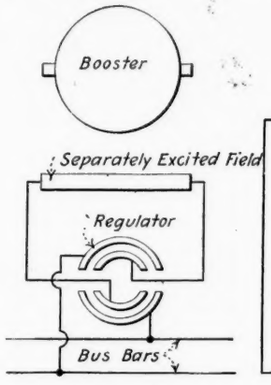


Fig. 13

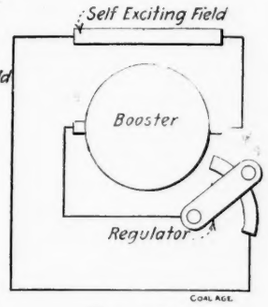


Fig. 14

were driven, before the installation of the exhaust-steam plant, by a pair of simple cylinder horizontal engines, furnishing together about 80 hp., and supplied with steam by a boiler near the pit, working at low pressure. At the time this plant was put in, it was the common practice to take steam underground. In the North of England, in the counties of Durham and Northumberland, where the most advanced practice was usually to be found, it was a common thing for steam to be taken considerable distances in-bye, and the working of a haulage plant by steam engines, near the pit bottom, exhausting into the upcast shaft, was also quite common.

At the Hucknall colliery, the haulage extended about 1½ miles on one side of the pit bottom, and for about half a mile on the other side. There was also a small rope arranged to haul the trams round the shaft bottom. The engine and boilers were taken out, and the 60-hp., three-phase, induction motor installed; this motor was guaranteed to be capable of giving 100 hp. for four hours without undue heating. The two endless ropes were driven from a single shaft, by the aid of clutches in the usual way, the driving shaft taking power from the motor by means of a series of belts.

Some careful tests were made of the power required to work the haulage plant, and it was found, as in other cases, to be less than the sum of the two powers required for the two ropes working separately. The smaller quantity of power required, and the reason, is perhaps best seen by taking the case of a large engineering works, with a number of machine tools. Going through the works, it will be found that perhaps one machine is standing, while the man looking after it is setting a tool; another machine perhaps will be taking only a light cut; a third may be taking its full cut, and so on, the result being that only the smaller quantity of power mentioned above is required.

The running costs of the plant at Hucknall are quite low indeed, so low, in fact, that the manager of the colliery stated that he would not like it to be known for business reasons.

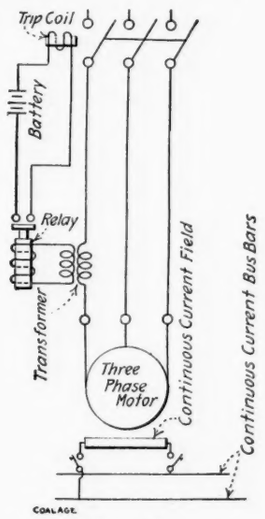


Fig. 15

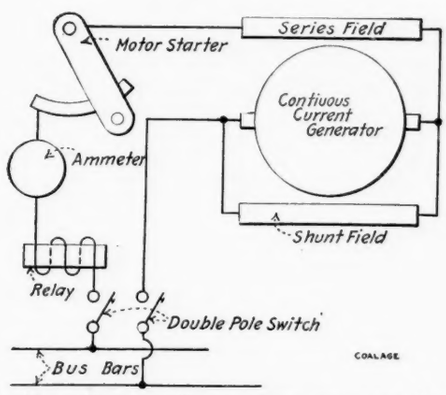


Fig. 16. Trip Coil on Continuous-current Generator

SNAP SHOTS IN COAL MINING

1—Tipple at mine No. 2, West Kentucky Coal Co., Sturgis, Ky.

2—Main shaft and general surface plant No. 2 mine, Dominion Coal Co., Glace Bay, N. S.

3—Primitive charcoal burning, La Paz, Coahuila, Mex.

4—Mary-Lee seam in the Warrior field, Warrior-Pratt Coal Co., Porter, Ala.

5—Plant at the Lady Wellington mine of the American Coal Co., Spiketon, Wash.

6—A hoisting shaft, 1000 ft. deep at No. 2 mine, Dominion Coal Co., Glace Bay, N. S.

7—A gravity-screen tipple at the Patrick-McKay mine, Roslyn-Cascade Fuel Co., Roslyn, Wash.

8—Electric slope hoist at Lincoln colliery, Philadelphia & Reading Coal & Iron Co.; 170 hp., 220 volts, 385 r.p.m.

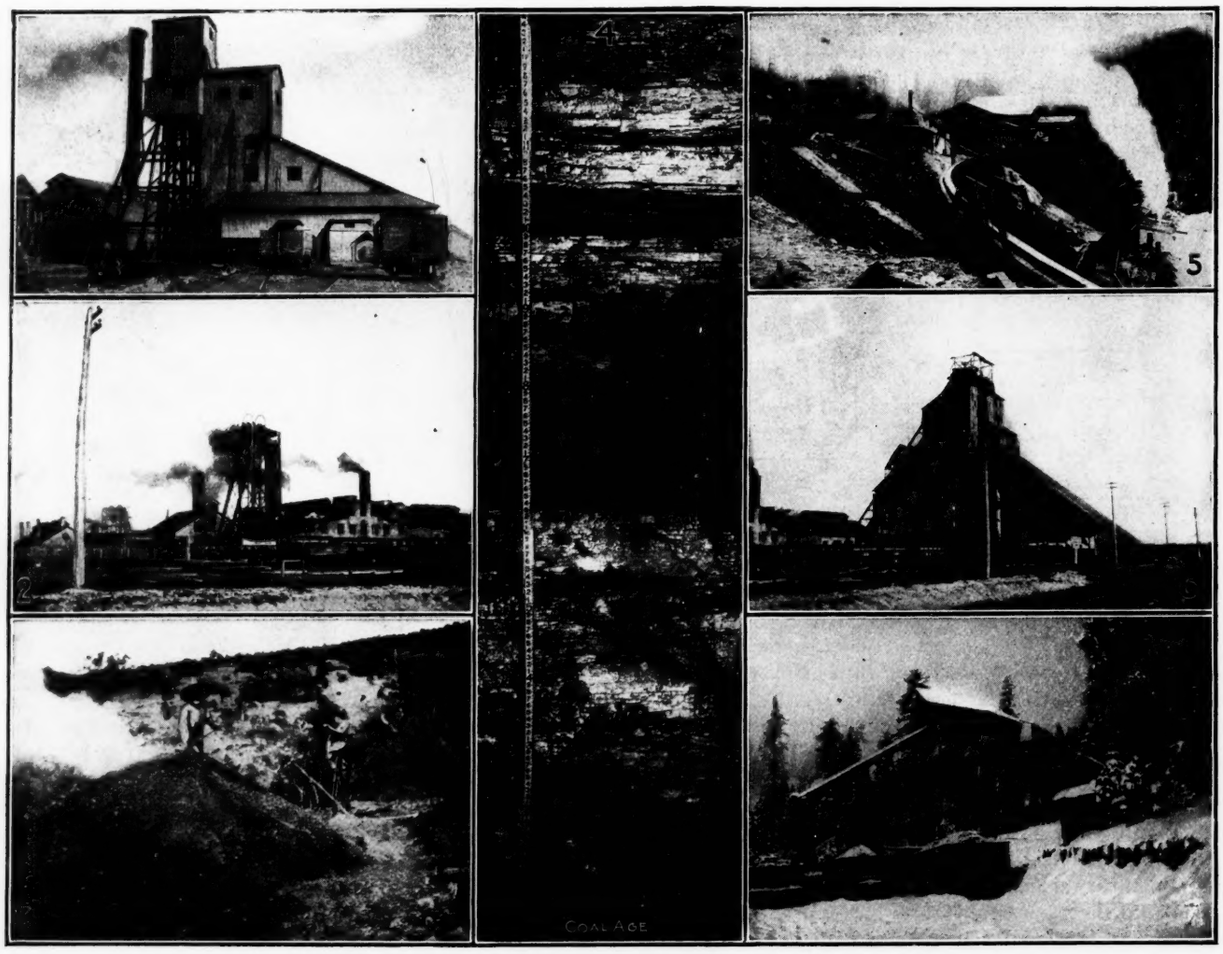
9—Transmission towers of the United States Coal & Coke Co., Gary, W. Va.; 75 ft. high.

10—Fan motor of Turkey-Run colliery, Philadelphia & Reading Coal & Iron Co., Shenandoah, Penn.; 50 hp., 230 volts, 200-400 r.p.m.

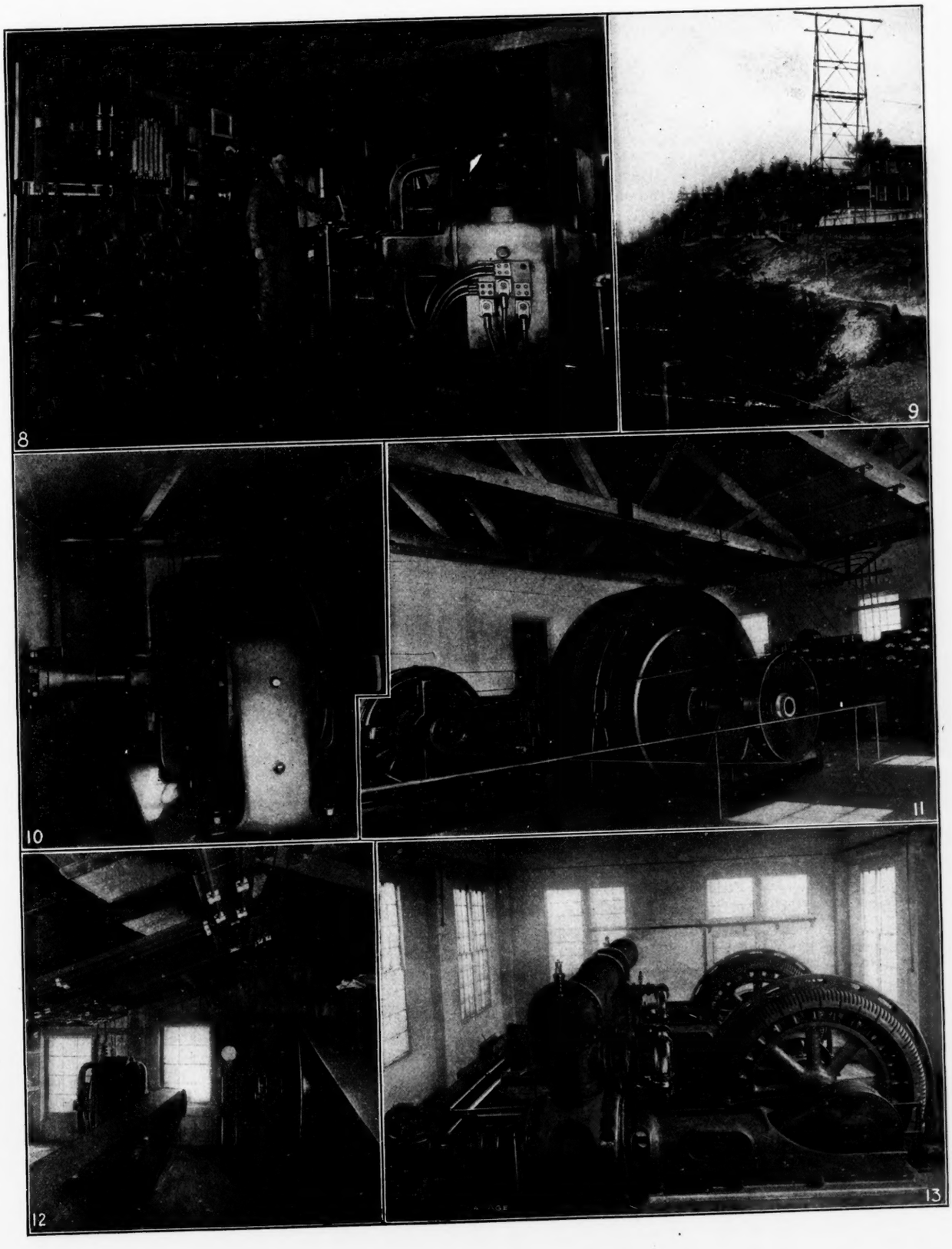
11—Alternator with belted exciter, at Bear Valley colliery, Philadelphia & Reading Coal & Iron Co., Shamokin, Penn.; 400 kw., 2300 volt, 3 phase, 60 cycle.

12—Air compressor at the Luzerne substation of the Rochester & Pittsburg Coal & Iron Co. Each is direct-driven by a 450-kv.-a., 6000-volt, 125-r.p.m. synchronous motor.

13—A 75-hp., 220-volt, 430-1075-r.p.m., shunt-wound motor, driving 18-ft. fan through countershafting at North Franklin colliery, Philadelphia & Reading Coal & Iron Co., Treverton, Penn.



Some General Electric Power Installations

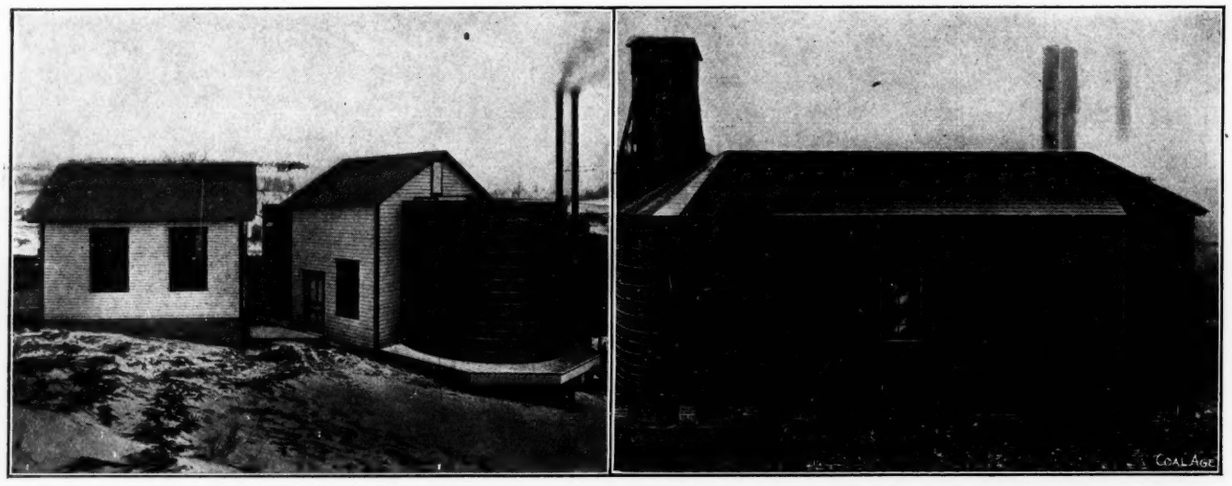


Feed Water Purification at Mines

Special Correspondence

SYNOPSIS—The feed waters encountered in mining regions are frequently both scaling and corroding in their nature. If used in their raw or untreated state, even though heated to a considrable extent before being forced into the boilers, much trouble and expense is liable to be incurred. A system of water softening and purification is here described which has been successfully installed at many mines.

In many steam power plants in coal-mining regions, particularly those which draw their boiler-feed water from sources which have been contaminated with mine drainage, considerable difficulty has been experienced from either scale or corrosion, or both. The fear of the expense and danger arising from these causes is strongly evidenced by the large number of boiler compounds, purifying devices, skimmers, filters, etc., which are upon the market.



Feed-water Purification Plants at Burgettstown, Penn. (at the Left) and at De Lancy, Penn. (on the Right)

The Origin of Scale

Incrustation and corrosion can nearly always be traced to the iron, lime and magnesia salts in solution in the water, or in some cases to the free acid which it carries. The physical character of the scale depends upon the acids combined with the iron, lime and magnesia, upon the type of boiler in use and the rate, temperature and pressure at which it is operated.

To overcome the waste and expense due to the operation of boilers with water containing one or more of these impurities, many methods and devices are in use, nearly all of them depending upon sound mechanical or chemical theory. But many of these devices fail to perform in the fullest measure what is expected of them, or are at best only partially successful due to improper application or to the fact that effort is directed against the effect rather than the cause.

A water, which to the eye seems to be absolutely clear, one which is known to be perfectly good and safe for drinking purposes, may contain so great a proportion of scale-forming material as to be extremely undesirable for boiler-feeding purposes; likewise a stream which near its source shows good analysis, and not enough foreign matter to cause any trouble in a boiler, at points lower down, due to contamination from outside sources, may show both scaling and corroding properties to a marked degree.

To decide on the suitability of a water for boiler-feeding purposes, an accurate analysis is essential. This should be complete and be carefully made by a chemist who, if possible, is a specialist on boiler-feed waters.

An analysis of the scale in the boiler is of practically no value in determining the character of the water from which the scale was deposited. This is due to the fact that incrustation is a precipitation resulting from reaction between some of the substances in solution, as well as to the heat and concentration, so that the original character of the impurities and their amount in the water in question is not always apparent from the scale.

Objectionable Sources of Supply

Mine waters, creeks and streams fed with mine drainage are objectionable on account of the free sulphuric acid and corrosive sulphate of iron and alumina as well as the other scale-forming substances which they carry in suspension.

The sulphates of iron and alumina in such supplies act in the boiler exactly like sulphuric acid, inasmuch as they are dissociated by heat, the acid being thus set free, and the iron and alumina precipated as sludge or scale.

The sulphuric acid liberated as well as that introduced in the free state with the feed water immediately attacks the metal of the boiler, forming iron sulphate, which the heat decomposes, freeing the acid and forming iron hydrate, which gives the water the characteristic color of iron rust.

The acid liberated by the reaction due to heat is constantly repeating its destructive action upon the metal. Sulphuric acid is nonvolatile; consequently its amount in the contents of the boiler is constantly being increased

by the quantity introduced with the feed, either as free acid or that combined with the iron or alumina. The destruction of the metal of the boiler may be said to be almost in direct ratio with the concentration of the acid which is contained therein.

Other corrosive acids and substances are often present in boiler supplies. Water which drains through swamps or marshes wherein there is much decayed vegetable matter often contains enough organic acid to cause severe and dangerous pitting. But in the mining regions sulphuric acid is the most common, and is also the most destructive to the piping, heaters, boilers, etc.

Scale Shortens a Boiler's Life

The effect of scale on the heating surface tends to shorten the life of any boiler. That over heating results from scale is certain. As a rule, the metal is not of such a quality as to stand continued overheating, and portions of the tubes eventually show the characteristics of cast iron in their structure. This condition is not uniform throughout the entire boiler, but is more evident in those parts which are exposed to the greatest heat.

The actual thickness of incrustation seems to have less to do with crystalization than the nature of the scale and the furnace temperature, which in turn is dependent on the rate at which the boiler is operated.

The second condition, the failure of tubes by blisters or blowouts, is more common in some types of boilers than in others, and as a rule is chargeable to the insulating effect of irregular deposits of scale, sludge or oil from which local overheating results. This condition is, of course, aggravated by the furnace gases impinging more directly on certain parts of the tubes than others, thus bringing about unequal heating and a tendency to drive the water away from the tube walls.

That scale and corrosion affect the life of the entire steam plant, as well as increase the maintenance cost, is self-evident. The full efficiency of the various devices installed to increase the economy of the steam plant, as well as that of the individual boiler, will not be reached therefore as long as any scale is allowed to form, or any boiler is permitted to be fouled with oil or sludge.

The attempt to prevent scale in the boiler by having it deposited in some auxiliary, such as a feed-water heater and purifier, is one of the most common methods of attacking the feed-water problem. It is a known fact that raising the temperature of water reduces the solubility of some of the substances in solution; but this does not justify this method of precipitation for purifying all boiler feeds.

Any attempt to make the open feed-water heater perform two separate functions, savors of a make-shift, since as its efficiency as a purifier increases, its efficiency as a heater diminshes. The mere fact that scale is deposited upon its walls or pans does not justify it being called a purifier any more than to call a boiler by the same name, for the reason that scale is deposited upon its walls or tubes.

The large number of nostrums and mechanical devices put into use indicates that the steam users realize how irrational it is to expect an economical purification of feed water to be accomplished in either boiler attachments or auxiliaries, or in the boiler itself by making use of various compounds.

Conditions of Greatest Efficiency

The condition under which the most economical and efficient boiler operation can be obtained is with the use of clear, soft, noncorroding, nonscaling feed water. The problem, therefore, before the mine operator who has at his command only a supply of objectionable water is that of purifying and softening the boiler feed before it enters either the heater or boiler.

The process of softening and purifying water deals with the problem in the manner perscribed by the chemist, by the use of proper reagents which neutralize corrosive acids and change the soluble salts of lime, magnesia and iron into insoluble precipatates which can be removed by sedimentation and filtration. These can easily be accomplished in apparatus designed with all the chemical and mechanical requirements kept constantly in view.

The impurities in a water of average hardness (say 20 grains per gallon) only represents about $^4/_{100}$ of 1 per cent. by weight. This being the case, it becomes of vital importance that an exact weight of the reagent be mingled with a measured volume of the water in order to produce complete chemical reaction (in which time is also a factor). The use of sludge from previous softening to aid sedimentation, and perfect clarification by filtration are also important features which must be considered in order to obtain results that will compare favorably with a natural soft water.

The operation of a softening and purifying system requires only the exercise of common sense and ordinary care.

It is possible with a properly designed and operated system of this kind to eliminate or neutralize any acids, to completely remove all permanent hardness, to reduce the remaining scale-forming substances to less than three grains per U. S. gallon, and to produce a clear effluent.

Any water-softening system that fails to give these results is either faulty in design or improperly operated.

The cost of water purification will, of course, depend upon the amount of the reagents required, and these in turn upon the quantity and kind of impurities. It is readily understood that it costs more to remove 25 grains of carbonate of lime than it does to remove 10 grains, not because the method is any different, but because a greater quantity of reagent is required to bring about the precipitation.

Two Types of Water Softeners

There are two types of water-softening and purifying apparatus in use, the continuous and intermittent. With the continuous system the introduction of the reagents depends upon a proportional feeding device, and hence adjustment must be made in the quantity of the chemicals introduced to meet every variation or change in the water. This being the case, an error must necessarily occur, whenever the quality or quantity of the water varies.

On the other hand, in the intermittent type, measured amounts of water are treated, and the exact quantity of reagent is determined by weight. It is possible, therefore, to accurately treat any water, no matter how it may vary in quality or in quantity.

No automatic arrangement to adjust the quantity of reagents to the impurities of various kinds in water has yet been invented, nor is it probable that one will ever be devised. Therefore, this vital function of the process

must be performed by the operator, and the care and intelligence with which it is done practically determines the efficiency of the system when there are no faults in design.

Any softening effect will improve a bad boiler feed, but to obtain the best results, accurate treatment, which means careful attention, is absolutely essential.

The water-softening and purifying apparatus manufactured by William B. Scaife & Sons Co., and known as the We-Fu-Go system, may be considered as a typical example of the intermittent purification process. Such a device renders its owner independent of uncertain weather conditions or surface supply, as water from any source can be utilized.

The Essential Elements of the System

This system consists essentially of two or more treating and settling tanks, equipped with mechanical stirring devices operated by power, a small reagent or chemical-mixing tank with mechanical stirring device and a jet or other pump for introducing the reagents into the treating tanks, and a filter.

The treating or reaction tanks are filled alternately with water. While a tank is filling, the reagents are introduced and thoroughly mixed with the incoming water by means of the mechanical stirring device consisting of a specially designed paddle revolved by power from an available line shaft, an engine or a motor.

The paddle not only mixes the reagents with the water, but at the same time stirs up from the bottom the sludge of preceding purifications. This sludge held in suspension in the water, hastens the chemical reaction and causes the new finely divided precipitates to form large wooly flakes, heavy enough to settle quickly as soon as the water stops moving.

The mixing device is the simplest and most efficient that can be constructed. With reasonable care it will not get out of order. It does not have to be frequently cleaned to keep it in working condition, and requires but very little power.

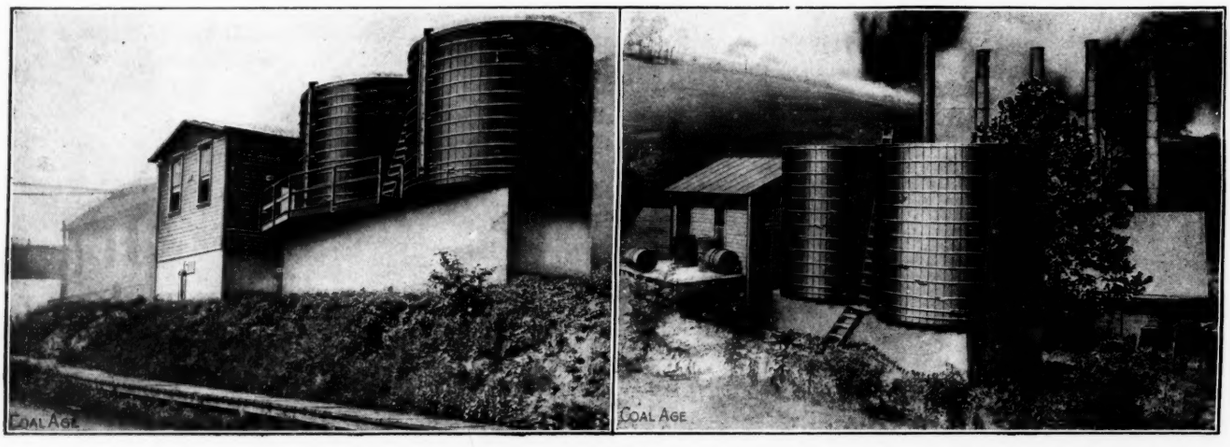
After a tank is filled the stirring device is stopped, and the water permitted to stand, in order to allow the precipitates to settle to the bottom. The softened water is removed by means of a hinged floating outlet pipe, arranged to rise and fall with the level of the water, so that the latter is always drawn from the top.

The water near the surface being the cleanest, carries the least amount of floating sludge through the outlet pipe to the filter bed. Therefore, the latter can be run the longest possible time without being cleaned. The rate of flow through the filters is automatically controlled, so that they are supplied with water as fast as it is drawn from them. Either pressure or gravity filters may be used.

While one tank is being filled, treated and settled, the other is supplying pure water; and by the time it is emptied the first tank is ready for use. In this way a constant supply of accurately treated, clear water is always available.

Pipe Connections Located in Tank Bottom

Pipe connections through which the tanks are filled, and also those which carry away the sludge are placed in the bottom. The washing of the settling tanks needs only be done once a week, or when the sludge becomes deep enough to interfere with the rotation of the paddles.



Two We-Fu-Go Feed-water Purification Systems. The One on the Left is Located at Oakdale, Penn., and that at the Right at Noblestown, Penn.

To clean out these tanks it is only necessary to open the valves to the sewer and start the stirring device which mixes up the sludge, this being soft enough to go through the pipe into the sewer.

The results accomplished with this apparatus are the following:

Accurate chemical treatment, thorough mixture of the reagents with the water, accelerated and complete chemical reaction, rapid sedimentation and perfect clarification.

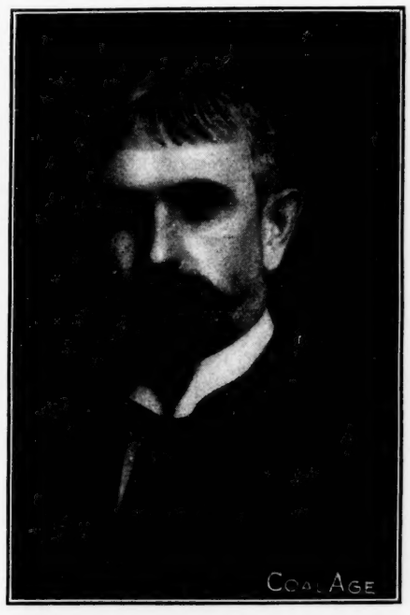
With a properly softened water there will be no scale formed in heaters, pumps, pipelines or other auxiliaries, because the salts of lime and magnesia will have been removed to a point below their normal solubility. So that at the higher temperature that may be obtained without concentration, no accumulation of scale will occur.

Neither will such a water form scale or cause corrosion in the boiler. Incrustation cannot take place even with indefinite concentration, for the small amount of lime and magnesia salts left in the water are of such a character that when precipitated as a result of concentration in the boiler, only a slight sludge is formed.

WHO'S WHO—IN COAL MINING

Edwin Ludlow was born at Oakdale, Long Island, N. Y., and graduated from the Columbia School of Mines in 1879. In order to put the test of practical usage, on his long years of theoretical training, he engaged with the United States Engineer Corps under his brother, the late General William Ludlow. This early work included the surveying of various rivers and harbors on the New Jersey coast from Shrewsburg south, and on the Delaware River from the city of Trenton to Delaware Bay.

At the end of two years, young Ludlow found himself in charge of the hydrographic work of the department, the highest position in the service open to civilians at that time. While casting about for a new field with greater possibilities, he was offered a position in Mexico, which appealed to the adventurous side of the man, and he accepted. Accordingly, the year of 1881 found him, in company with two other engineers, one servant and one pack animal, engaged on the reconnaissance of the Mexican National R.R. from Laredo, Tex., to Mexico City. Some eight months were consumed in covering this eight hundred miles of mesquite- and tarantular-infested country, and our modern engineer, accustomed to elaborate camp equipments, will appreciate the hardships entailed by such a meager outfit. Added to this, the party ultimately arrived at their destination, only to find that the company was in financial straits, which necessitated the discontinuance of all further activities for the time being.



EDWIN LUDLOW

Returning to the States, Mr. Ludlow made his *debût* in the coal industry as assistant superintendent of the Mineral Railroad & Mining Co., one of the anthracite subsidiaries of the Pennsylvania R.R. Co., with headquarters at Shamokin, Penn. Being a novice at this new vocation and obsessed with an insatiable desire for first-hand knowledge of the real practical issues, he spent much of his time, dinner pail in hand, underground. At the end of two years, young Ludlow was appointed superintendent of the Union Coal Co., which concern had just leased two of the Mineral Co.'s collieries and, in 1885 when Major Stearns was made general manager of all the coal properties of the Pennsylvania R.R. Co., Ludlow was promoted to the superintendency of the Mineral Co. During his four years' incumbency of this position he was actively engaged in carrying out an extensive development propaganda, under the direction of Major Stearns, and incidentally he installed the first water-tube boilers and chain conveyors used in the anthracite regions.

In 1889, Mr. Ludlow was asked to take charge of the development of what was then a virgin coal field in the Indian Territory, now Oklahoma. Preliminary geological studies of the district had been made by H. M. Chance and Ludlow's instructions were to extend the known areas of workable coals, see that the line of the Choctaw Coal & Ry. Co., then being constructed, was located in the most advantageous position for working same, and develop mines to provide a large tonnage for the road. The field was some eighty miles in length and during the early constructive period Mr. Ludlow made a buckboard his headquarters, spending only sufficient time at the office to place orders for the supplies required at the rapidly-building camps. To step into another man's shoes and follow out tried and approved methods of procedure requires a certain ability sometimes, but to tackle the many problems incident to developing a new field on a large scale, and at the same time build up a working organization from the ground, requires an executive ability and a capacity for original thinking that probably few engineers possess. The present-day importance of the district he opened stands as a monument to the success which attended his efforts.

After ten years at the Oklahoma mines, Mr. Ludlow was again called upon for pioneer work, this time in Mexico. At the head of an American concern he was the original operator in the now well known Sabinas field in northern Coahuila, and in three years transformed a bare desert into a thriving and attractive mining camp, incidentally putting his company on an earning basis of six hundred thousand dollars per annum. Handicapped by unfavorable mining conditions, a meager supply of trained assistants, and forced to draw his labor from an inexperienced race of people, accustomed to the intermittent work of ranch life, the ability of the man was put to a severe test. Nor were his problems confined entirely to the operating end. New markets had to be created, steam consumers prevailed upon to install fireboxes suitable for using the inferior local product and today an important railroad system and many large industries rely exclusively upon this district for their fuel.

The evident success of the American company attracted new capital to the field, and other mines were rapidly opened up which ultimately developed into important competitors of Mr. Ludlow's company. His mining problems were, at the same time, becoming more complex at the increased depths, and in order to effect greater economies, and provide funds for sinking a 900-

ft. shaft (the deepest coal shaft in Mexico) he installed what is today the most modern battery of Koppers waste-gas ovens on the American continent.

Ability such as Mr. Ludlow's was, obviously, too rare to be confined to the relatively small operations on the frontiers of civilization and it was inevitable that he must eventually gravitate to the large mining districts of the East. In 1910 he was chosen vice-president and general manager of the New River Collieries Co., and, although only with that concern about one year, his work in this field was particularly effective and brought the results which the company had been seeking for a number of years.

In March of last year Mr. Ludlow accepted a position with the Lehigh Coal & Navigation Co. as vice-president, in charge of the mines. At the time of his appointment to this position the late W. A. Lathrop said of him: "Mr. Ludlow brings to his new situation a long experience with mining problems and management and the company is to be congratulated upon having secured his services." A more tangible tribute to his ability, however, was made by William C. Potter, vice-president of the Guaranty Trust Co., who said: "He has that rare combination of technical and executive ability which is in such great demand today."

Edwin Ludlow is essentially a man of contradictions. Debonair, blasé, almost Chesterfieldian in manners, a member of New York's most exclusive clubs, and an epicurean of no mean discernment, he is none the less at home in the mines, will answer to the call of "grub-pile" in a cow-camp, with the avidity of the normal "puncher" and then show the latter a few of the fine points in throwing a "diamond-hitch." He is by all instincts and training an Eastern man, while a handsome loving cup, presented him in the West, speaks eloquently of his popularity there. No more princely host or thorough disciplinarian exists. A man of quick decisions, tempered however, by a full appreciation of human failings, he has invariably won a loyalty and an *esprit de corps* among his men that is all too rare. Incisive in his orders, he inspires an immediate confidence that has stood him in good stead during the inevitable mine disasters, when directing his men at the face, where he prefers to be.

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A Modern Power Plant

The Lehigh Coal & Navigation Co. is building a power house at Hauto, seven miles above Maunch Chunk, which will transmit current at 110,000 volts anywhere within a radius of 175 miles. The power house is being built of brick, the operating room being 180 ft. long, and the boiler room 385 ft. long and 70 ft. wide. The dam will be 1700 ft. long, and the height of its embankment 31 ft. The width at the base is 150 ft., and 15 ft. at the top. Broad Mountain and Nesquehoning Mountain form the sides for the new reservoir, which, when completed, will entirely cover the old L. C. & N. dam.

The boilers are of the water-tube type, having a capacity of 1000 hp. each. The water will be taken from the reservoir and, after passing through the turbines, it is to be condensed and returned through an open canal to a point midway in the new reservoir. The water will circulate through the reservoir until it again reaches the intake tunnel, when it will go into the plant to be used again.

Three turbo-generators of 1000 kw. each are to be installed at the beginning. A three-phase current will be generated at a voltage of 11,000 volts, which will pass through step-up transformers until it has reached the transmitting voltage of 110,000 volts. Galvanized steel towers will be used for supporting the cables of the transmission line. The towers will be 78 ft. 6 in. high, and will be spaced about 600 ft. apart.

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A New Bond for Butt Entries

In coal mines, the haulage tracks in cross headings or butt entries are used for only a comparatively short time before they are taken up and removed to new workings. In order to meet this condition, the Ohio Brass Co. recently designed their type N removable mine bond for the exclusive purpose of bonding temporary tracks.

This bond differs from compressed terminal bonds, in that it may be readily removed without injury when the temporary tracks are taken up and it can be used over and over again.

Before putting the type N removable mine bond on the market, the makers placed a number in actual service in mines and kept a careful record of their performance and have proved conclusively that they are much

IMPROVED TYPE OF BOND FOR USE IN COAL MINES

more efficient than channel pins, which have hitherto been largely used for bonding temporary work.

Briefly, this bond consists of two tapered steel terminals joined together by a flexible copper cable (Fig. 1). This cable is headed and soldered into the terminals, which are tinned all over. The taper has been carefully worked out so that when the bonds are first installed they need only be driven in a short distance. The next time they are used they are driven in a little further, and so on.

Application is extremely rapid, as the bonds are simply driven into holes drilled in the rails by a few taps of a hammer, no special tools being required.

A standard 5/8-in. drill is used to bore the hole in the web of the rail, and the bond terminals broach this hole so that it conforms to the taper of the bond.

The design of the bond is such that it will go around the fish plate (Fig. 2), thereby making it unnecessary to remove the generally rusted fish-plate bolts in order to install the bond. This feature makes inspection or removal much easier.

As previously stated, this bond is designed exclusively for temporary tracks, while on main-line haulages the compressed terminal type of bond should be used.

EDITORIALS

High Fan Efficiency

A great majority of the fans and blowers used in the ventilation of coal mines are sold under guarantees of performance. Unfortunately, however, it is seldom that the means and methods to be employed in the acceptance tests are mentioned in the contract. Almost invariably, if properly set up, in accordance with the instructions of the builders, these machines measure up to their specifications.

It is not at all uncommon to read of ventilating fans, even of the disk type, having an efficiency of 70 to 80 per cent., or even higher, while some manufacturers appear to have no hesitancy whatever in guaranteeing such high performances.

Almost invariably, also, the acceptance trials are conducted with the aid of an anemometer, the shortcomings of which are well known. So unsatisfactory and inaccurate may these instruments become, particularly when used in strong air currents, that it is believed by some engineers that results obtained from their use are, or rather may be, quite as unreliable as a guess.

In an article appearing in *Engineering News,* Vol. 65, p. 558, A. H. Anderson says: "A simple centrifugal blower with six radial vanes has an efficiency of about 40 per cent. A later type having a large number of narrow vanes has an efficiency of about 60 per cent." These figures closely corroborate determinations made by Prof. R. C. Carpenter.

W. G. Walker, in experiments on disk fans of uniform size and speed, but varying shape and angle of blades, found efficiencies ranging from 4.7 per cent. to 43 per cent. All of the above, it should be remembered, were laboratory tests conducted in a most careful and scientific manner.

If approximately 60 per cent. is the best that can be obtained from a centrifugal blower when on the testing floor under the most favorable conditions, it is hardly natural to expect better results when in operation at the mine. The careful mine owner or engineer may well look askance therefore, at the extremely high efficiencies guaranteed by some fan builders.

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The Strength of Law

The strength of law is in the approval of the citizens. Never was an act passed which served its purpose, if the people were opposed to its execution. The law must be accompanied by the right sentiment or it will be only a job for the public printer.

When a man is killed, the common cry is, "Lynch the murderer," but in more civilized communities it is changed to "Apply the law." Everyone who saw the crime gives evidence; the whole community hopes that the criminal will not escape.

If such a sentiment backed the mining law, if the thought of everyone was to let the law be enforced, we would not have so many accidents. It would be dangerous to violate the mining code. The inspector would find witnesses at hand to testify against the violator. He would not have them slip away and leave him with a weak case when the matter came to court.

The change is coming. It will be before long as easy to put men in jail for neglecting to take precautions as to incarcerate them for "stealing cars" or appropriating picks. An act, which puts in danger a mine full of men, has not as great a justification as can be brought forward for changing checks or sawing the mark off a pick handle.

No man who committed such a petty theft would have his fine paid by the union, although at present there are those who claim that the penalty which is imposed for a violation of the mining law, is often paid from union funds. This is an evil feature in the attitude of labor. It is not what is known as "solidarity of the working classes." It permits the criminal to injure his brother man. Surely men are not banded together for the purpose of having the careless injure others who are innocent of wrongdoing.

In fact, we should not be satisfied with the law alone. The man who steals cars has to move away from the place where he committed the act; the disapprobation of the community makes the journey necessary, and the man who jeopardizes a mine should find it best to leave, and in fact, as mining is essentially an occupation where the careless usually injure more than themselves, the man should be compelled by some provision of the law to enter a life work where his folly and dishonesty of purpose could no longer constitute an offence against his fellow men.

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The Central Power Station Idea

During a a comparatively recent period of time, the idea of the central power station has been rapidly gaining headway. It has been found that power losses, even over transmission lines of considerable length, are less costly than are fuel freight rates for the same distance.

Already we have hydro-electric developments supplying current to large coal-producing areas, and steam- or gas-power stations projected in the heart of coal-mining regions, where the fuel as taken from the ground possesses, as an article of commerce, its first and least value.

In the present state of power engineering, it is idle to hope that unit efficiency or even any approximation hereto, can ever be attained in any thermo-mechanical or thermo-electric plant, as a certain amount of heat energy is invariably wasted in any process involving fuel consumption. But, since heat losses are inevitable, it would appear to be the part of wisdom to permit these losses to take place only at the point where the fuel involved represents the least possible outlay in actual time and money.

A Fan Question

We publish, in the Discussion department this week, a criticism of our answer to a recent examination question, by one of our readers, at his special request. The criticism is an honest one, although as we have tried to show, in a brief editorial note following the criticism, the correspondent misjudges the conditions involved in the question.

When a criticism or other contribution is evidently in error we do not publish the same except upon the special request of the correspondent; and then only when the question involved is an all-too-common mistake, which we hope to correct, in a measure, by a free and open discussion.

In the present case, the point of issue is the reduction of the air volume caused by an increase of water gage, for the same speed of the fan. Our correspondent says the air volume is always "proportional to the speed of the fan, irrespective of the water gage."

The point to be impressed, here, is that the water gage, in mine ventilation, may be increased in two ways:

1. By increasing the speed of the fan.
2. By increasing the mine resistance.

In this question, the increase of gage, *for same speed of fan,* can only be due to an increase in the resisting power of the mine, which means a less air volume, less work lost in fan, slightly greater fan efficiency and less power required to produce the same speed of fan.

Slack

The problem furnished by the absence of demand for slack is likely to be severe so long as such a large number of coal corporations still burn run-of-mine coal. It would pay the mining companies to get together and engage a capable canvasser who would watch new installations in the cities and urge the introduction of uptodate slack-burning and self-feeding boilers. We believe that an energetic campaign might be made which would double the demand for slack and make the price such that the extreme care in preparation and mining might be relaxed.

However, the man who undertook to press the claims of slack on the attention of the smaller consumer would have to keep silent about the conditions at many of the mines which he represented. He would not be able to fortify his claim by showing how much his companies were saving by their use of small sizes and the reduction of stoking labor.

The Harger Plan

We think the Harger plan, as originally laid out, was sufficiently discredited by the public before Mr. Burrell made his address at Parkersburg, W. Va. Nevertheless, we do believe that it may ultimately be found available in connection with shotfiring from the surface. When no one is in the mine, it will be possible to fill the workings with carbon dioxide and oxygen-depleted air, so that the only things which are likely to burn will be explosives which contain their own oxygen. In this way both mine fires and explosions will be prevented.

When the mine is entirely depopulated, its atmosphere can be made so foul as to be destructive to life. The short time during which this condition will be maintained will involve less cost than 10 hr. of lesser air pollution.

Electricity in Coal Mining

It is probable that in no branch of human activity does the power of electricity meet with a more diversified field of usefulness than in coal mining. Although all of the applications of this form of energy to mining processes may be divided into four great classes or divisions, viz.: the production of light, the distribution of power, the transmission of intelligence and the initiation of chemical reactions, the number and variety of the operations performed by its aid are scarcely less than legion.

Let us consider for a moment what manipulations in the mining and preparation of coal are, or rather may be, accomplished by means of this power. First the coal is undercut by electrically operated machines. Next the shot holes are bored by electrically driven augers. After the powder charges have been properly placed and made ready they are fired by electric detonators.

The coal is then loaded into mine cars by electric-shoveling machines. The cars are hauled to the shaft bottom by electric locomotives, controlled by an electric signal system, where an electrically operated cager counts them off and places them upon the cage.

The attendant then presses an electric button and the engineer on the surface receives the signal to start the electric hoist.

During the upward travel of the cage an electric tachograph makes a permanent record of the time, duration and rapidity of the hoist and warns the engineer by a visible or audible sign if the safe speed limit is being exceeded.

Upon arrival at the pit bank an electric ram pushes the loaded car off and an empty one upon the waiting cage. After removal from the mine car through the medium of an electrically driven dump, the coal passes first to electric shaker or revolving screens and thence to electrically impelled picking tables and loading booms.

Finally, after the mine product has been safely deposited in the railroad car, by means perhaps of an electrically driven box-car loader, the tipple foreman calls up the superintendent over the telephone and informs him that a certain railroad car of a certain number has been properly loaded with such and such a grade and is ready to be turned over to the transportation company for delivery.

In the above, only the processes wherein the coal is directly involved have been considered. No mention whatever has been made of the very common and important, although perhaps somewhat subsidiary uses for electricity, such as lighting, ventilation and drainage, to say nothing of the employment of electric head- or safety-lamps by the individual miners.

We can only view the future in the light of past experience. So rapid has been the progress of electricity in the ten or twenty years which are immediately behind us that its ultimate future utility is difficult even to conjecture. Yet, the basic principles underlying all electrical achievements and inventions are extremely simple—so much so, in fact, that we are often deceived and misled by their lack of complexity.

The wise operator, therefore, will rather encourage than discourage an inquiring spirit and a tendency to experiment with things electrical on the part of his employees, even though to him the experiments in question may appear to be crude, puerile or even silly.

Resolution

Upon the recent retirement of Richard Newsam, as chairman of the Illinois State Mining Commission, the following resolution was unanimously adopted and made a part of the records of the commission. The resolution but feebly expresses the high esteem in which Mr. Newsam, familiarly known as "Uncle Dick," was held by every mining man in the state

The honored chairman of this Commission, Mr. Richard Newsam, having announced that on account of his nearly three score and ten years, and the need of conserving his somewhat impaired health, he has felt it his duty to resign from this body, we, the members of the Mining Investigation Commission of the State of Illinois, do hereby place on record our appreciation of his services to the miners, mine owners and mining interests of this state.

It is his honor that in the early years of mining in this state, when the methods of mining were crude and primitive, and when scientific knowledge of mining was rare and little valued, he, with a public spirit unusual in those days, applied himself to the betterment of mining conditions and the increase of scientific knowledge, and made of himself one of the most important factors in the subsequent mining progress in the state.

As chairman of the State Mining Board, he labored to raise the standard of technical mining knowledge among inspectors, mine managers, examiners and others connected with the operation of mines, with the result that the standard of efficiency in Illinois from being among the lowest is now among the highest in the civilized world.

As chairman of the State Mining Investigation Commission, created in the shadow of a great mining disaster, he gave freely of his time, his knowledge, his ripe experience in mining matters, and his rare personal qualities in the guidance and direction of a deliberative body, with such purpose that the labors of the Board resulted in the production of what has been pronounced to be the best code of mining laws ever formulated in any state or country.

And all this he was able to do without advantage of academic or collegiate training. An English miner, inured to the use of the pick from early years, having entered the mines at the age of eight years, a man whose school was the pit, and whose university was contact with great minds through the printed page by candle light, he was yet able to qualify himself to be the leader in the application of science to the mining industry, and make of himself an authority in that science.

Most of all, he is to be honored for his devotion to public service, and the unstinted giving of time and energy to its interest, at a time when most other men were mainly concerned with making money. For many years, especially in the latter years of his busy life as a coal operator, he has withdrawn his working power from a business where it could have been coined into dollars and given it freely to the service of his fellow men, especially in making mining conditions in this state healthier and safer to life and limb for those who must earn their livelihood in the bowels of the earth.

The state needs such men. The patriotism of the future calls for heroes who will serve their country in the strife and stress of industry rather than on the field of battle and carnage. Because Richard Newsam has been a pioneer among such modern patriots, this Commission honors him as one of the great leaders of the mining industry in the State of Illinois and places on record this public testimony of its regard and esteem.

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New Coal Operation in Kentucky

SPECIAL CORRESPONDENCE

Work has begun on the entry of the first large coal operation in Perry County, and is being pushed ahead with the object of driving a double heading during the winter months, while outside work is impracticable. The Consolidation Coal Co. has had work under way for more than a year in Letcher County, which lies to the east of Perry, and on the head of the North Fork of the Kentucky River, but this is the first active step toward developing the resources of Perry County.

It is being installed by the Kentucky Jewel Coal Co., and the plant will be located about one mile east of Hazard. It is the purpose of the company to put in a plant with a capacity of 800 to 1000 tons daily. As soon as spring opens, work will commence on the branch railroad, tipple, incline and attendant buildings, and it is the expectation of the management to be shipping coal by midsummer. The seam to be operated is known as No. 7 in the correlation of the Kentucky Geological Survey, and contains 5 ft. of a high grade of splint coal.

The Slemp Coal Co., which is headed by C. V. Slemp, J. C. C. Mayo and J. N. Camden, is lessor to the Kentucky Jewel Coal Co. The officers of the latter are Dr. Samuel Bennett, of Middlesboro, president; J. C. Smith, of Chicago, Ill., vice-president; Dr. D. O. Foley, of Jellico, Tenn., secretary and treasurer, and H. E. Bulloch, of Pineville, general manager. Mr. Bulloch is moving his family to Hazard this week, and will have personal charge of the operation.

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Rocky Mountain Coal Mining Institute

A chapter was organized in Walsenburg, Colo., Jan. 13, 1913. Joseph Ball was chosen temporary chairman, and Lewis Hufty, temporary secretary. Others present were D. A. Stout, Charles H. Pete, John Shaw and John Neish. Permanent officers will be elected at the first regular meeting, Jan. 25.

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Power Factor Conditions

A fact not always appreciated is that the demands upon a generator increase as the power factor decreases. The power factor, of course, is determined solely by the load and not by generator conditions. Machines are rated in kilovolt-amperes, this rating being the product of the current and voltage output.

The prime mover driving the generator has its energy expressed in either horsepower or kilowatts. In order to successfully match generators and prime movers, it is necessary to know the maximum outputs of both, and the operating power factor, so that a generator, the limiting capacity of which matches the limiting capacity of the engine, can be chosen. The kilowatt capacity of a generator is equal to the kilovolt-ampere capacity only when the machine operates at 100 per cent. power factor, a condition which practically never exists with present-day commercial loads.

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Direct Current Turbo Generators

A small line of direct-current generators arranged for direct connection to steam turbines, the complete outfit, entirely self-contained, is made in capacities ranging from 25 kw. to 150 kw. The compactness, absence of reciprocating parts, simplicity and reliability, make these sets desirable for many applications where a small direct-current machine is required. For exciter sets in large central stations, or for small isolated plants, they prove exceedingly desirable.

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When installing a spray locate it in the center of the roadway near the roof and in such a way that the water will be discharged in the direction in which the air travels. One spray box is sufficient for each 5000 cu.ft. of air supplied per minute. A pressure of from 15 to 20 lb. per sq.in. is necessary to run a spray.

DISCUSSION BY READERS

Reducing Ventilation When Firing

Letter No. 6—The coal-dust problem has been discussed from time to time by good authorities, and much valuable information deduced, relative to the presence of this dangerous element in mines. Coal dust is now quite generally recognized as one of the important factors in propagating an explosion. Likewise, a few exponents of the practice of reducing the ventilation in mines, at shotfiring time, have urged this as a means of preventing mine explosions; but, in most cases have failed to give good reasons for their opinions. These advocates have been, for the most part, content with recounting their personal experiences, as proof of their contention.

I have been waiting patiently for someone to ascribe the danger of explosion to the explosibility of powder smoke when mixed with air; but so far no one seems to have made any allusion to this important phase of the question. On account of the close connection between the two subjects, I am compelled now to discuss both the explosibility of powder smoke and reduction of ventilation during shotfiring, at the same time.

The idea seems to be prevalent, in many minds, that black powder and dynamite do not give off explosive gas when used in blasting. While powder manufacturers admit that this is not true, they generally claim that the explosive gases generated are due to the incomplete combustion of the powder. However this may be, any miner of several years' experience when doing his own shotfiring, or any shotfirer who has used squibs instead of fuse will tell you of many instances where they "fired the powder smoke" in going back too soon after shots had exploded. With this suggestion any thinking man can readily realize the danger that may exist in a mine filled with powder smoke, provided a sufficient amount of oxygen is introduced into the smoke to make an explosive mixture.

During the past year it has been the writer's unpleasant experience to have investigated five explosions in mines. In each case the investigation showed that it took at least two shots to start the trouble. We invariably found that a bad or windy shot produced a dangerous atmosphere for the shots following. In one instance, our examination showed that a heavy dynamite shot, laid about four feet on the solid, had been fired in the place adjoining that in which the explosion started. This shot did not do its work, but blew the tamping; and the force of the wind was very apparent where it had traveled out through the crosscut into the adjoining place. The shot that had been fired in this place was a good shot, charged with black powder, and did its work nicely. Although this shot had no appearance of being overcharged yet it was here that the fire started.

Some may say that the first shot stirred up the dust, which the second shot ignited. This, however, was almost impossible, as after the heat of the explosion had passed over it we found the dust and fine coal still wet enough to squeeze into a ball, in the hand. No gas of any kind had been encountered, in either place, before the explosion; and none was found after the explosion; although, by reason of the stoppings being blown out, the circulation in these places was practically stopped. Our conclusion was that the second shot ignited the gas produced by the blownout shot; and, as the fire traveled only about 300 ft., we decided that this gas furnished practically all the material for the explosion. Had the mine not been in good condition an extensive and violent explosion would likely have resulted.

As stated previously, I believe the volume of air in circulation to be closely concerned in the explosibility of powder smoke. Another instance of a violent explosion that came under my observation, gave sufficient evidence that, here also, powder smoke was the sole explosive agent. The mine was an unusually wet one; the entries were muddy their entire length, and considerable trouble was experienced in keeping the rooms dry enough to allow the men to work. The ribs in both the entries and rooms were always wet, which puts dust out of the question, for there was none. The coal seam was near the surface, the shaft being only 40 ft. deep. Not a trace of explosive gas had ever been found in any of the workings, or in any of the neighboring mines.

The mine foreman, in this mine, was a staunch advocate of reducing ventilation at firing time. He had instructed the engineer how fast to run the fan, which was just fast enough to hold the smoke back sufficiently to allow the shot firers to keep ahead of it. However, on the evening of the explosion the shotfirers had been firing about 30 min. when they came out of the mine and asked the engineer to speed up the fan, as the smoke was bothering them. He refused to do so, as he would not disobey the instructions of the mine foreman. He suggested that the men wait a short time and allow the smoke to clear up. They did not do this but went over to the fan house and opened up the throttle, giving the fan full speed. They then returned to their firing and in a few minutes the explosion occurred killing them both. The mine was badly wrecked and there was considerable evidence of flame. The speeding up of the fan increased the supply of oxygen, which rendered the powder smoke explosive and a shot ignited the mixture.

At another time, when opening a new mine, we had for some time a number of light explosions, which, at times, were strong enough to damage the tipple. We tried shutting down the fan and had no further trouble. This was nine years ago and, from that time to the present, the mine has worked steadily, but the fan is always stopped at firing time. Some of the workings are now over a mile from the shaft. It might be argued that if sufficient air was kept circulating to keep the mine free from smoke there would be no danger from that source; but this could not be done in this mine.

To those who have observed the action of shots underground, when at close range, the ideas I am advancing will appear very reasonable. I once had an opportunity to watch the explosion of a black-powder shot in a room.

The fire extended from the face about 75 ft. and seemed to fill the entire room. Upon examination, it was found the shot had worked nicely. It was not thought to have been overcharged. It occurred to me that, after so much fire in the room, there could not be much oxygen left in the air; and the question was suggested: If an explosion should originate in an adjoining room, what would be the result, by reason of this atmosphere from which practically all of the oxygen must have been burned. Even, supposing that the room was full of fine-coal dust, would an explosion be propagated through it, in the absence of oxygen?

The argument is that the reduction of air supply is an aid in the prevention of an explosion, because of the lack of sufficient air to form an explosive mixture. The reason that this is harder to control in winter than in summer is because the natural ventilation in a mine, in winter, makes it almost impossible to limit the supply of oxygen unless all intake openings are closed.

I realize that these remarks will meet with some severe criticism; but if they arouse a lively discussion on the subject they will have served their purpose. It may be claimed that the reduction in the percentage of oxygen in the mine atmosphere, by the flame from shots, would not make any appreciable difference in the explosive mixtures caused by blasting. In answer to such a claim, however, I would ask that careful investigation be made as to the necessary reduction in the percentage of oxygen in order to render the most explosive mixtures harmless.

C. W. WATERMAN,
Genl. Supt., The Fleming Coal Co.

Pittsburg, Kan.

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Letter No. 7—Referring to the matter of reducing ventilation by slowing down the fan at firing time, allow me to say that my experience of 35 years in the mines, in every capacity from trapper to superintendent, has taught me that this is a dangerous practice. Mr. McAllister, in his several letters, has described practices that every good mining man must condemn as unreasonable. I would neither try such methods myself nor recommend them to others. The operators in Indiana think more of their property than to allow such a method to be adopted and the shotfirers here would not risk their lives in the mines, if they knew that the fan was not in good condition and running at its normal speed.

It is the general practice, in our district, to speed up the fan before beginning to fire shots. Suppose, for example, a 20-ft. fan is run commonly at a speed of 40 r.p.m. during the day. At firing time, its speed would probably be increased to 60 r.p.m., especially in mines where gas is generated in any quantity. It appears to me unreasonable that mining men of experience should recommend firing from 100 to 300 shots, in a mine without any air in circulation. Our doctrine is that the fan should be run continuously for 24 hours of the day, with an increase in velocity of, say 25 per cent. while shotfirers are at work.

At the present time, I am firebossing at the Wizard mine, and I am certain not one of our shotfirers would go into the mine to perform this work, if the fan were to be shut down. Not only this, but the superintendent would not allow such a practice. We believe in good ventilation; air-tight stoppings and overcasts; withdrawing the men from the mine in case the fan is stopped or in case of explosion; keeping on hand a good supply of safety lamps; and the examining of every shot before firing.

I always advise our miners never to leave a shot to be fired that they would not like to shoot themselves. My advise to shotfirers is to make a personal examination themselves and be sure that the fan is running at its proper speed before going into the mine to fire shots.

JOHN SUTTON.

West Terre Haute, Ind.

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Letter No. 8—Referring to the criticism of Mr. McAllister's article on "Reducing Ventilation When Firing," COAL AGE, Jan. 4, p. 24, by R. Z. Virgin, Jan. 18, p. 111, it seems to me that both of these men are in error. Mr. Virgin's criticism is seemingly based wholly on the assumption that the ventilation was merely reduced in quantity; while Mr. McAllister, it seems to me, has sought to make it plain that he advocates closing the mine tight and thus completely shutting off the ventilation.

Assuming that Mr. McAllister's article refers to the complete stoppage of ventilation when firing, it should be headed "Stopping" instead of "Reducing Ventilation When Firing." Taking that meaning, it is obvious that this will produce or establish a condition in the mine that will be unfavorable to explosion. When oxidation continues in still air, the percentage of oxygen in the air is decreased while the percentage of carbon dioxide is increased, which produces an atmosphere that will exert a retarding influence on any explosion that might be started. As the oxygen in the air is reduced, the nitrogen remaining is in excess; and this excess of nitrogen will likewise act to still further retard explosion. Admitting these facts, one can readily see that there is something, in the narration by Mr. McAllister that is worthy of consideration.

Mr. Virgin divides his argument under three heads. His first point, which seems to me to be absurd, states:

> Percentages of gas that are not previously explosive become explosive in proportion as the volume of air is decreased.

According to this argument, the *minimum* volume of air will produce a *maximum* explosive mixture, which, it seems to me, is contrary to all teaching.

His second point states:

> Percentages of gas that are not previously explosive become explosive under the pressure of heavy blasting in a confined space where the air is dead.

Now, "dead air" is, as I understand it, air devoid of the life-sustaining element, oxygen. In such air, certainly there could be no explosion.

The third point states: "The reduced air current will carry a large percentage of dust, etc." But still air will carry no dust. Water is said to carry a weight of material in proportion to the sixth power of its velocity. Applying the same principle to air, a reduced velocity would carry much less dust than a current of high velocity.

JOHN RAE.

Hanna, Wyo.

[Referring to the above, if the firedamp mixture contains an excess of air, a reduction of the air volume, for the same flow of gas in the mine, would cause the mixture to approach the maximum explosive point, which is evidently Mr. Virgin's meaning.

"Dead air" in ventilation generally relates to a stagnation of the air current in the mine, it does not refer to any deficiency of oxygen in the air.

The third point stated by Mr. Virgin contemplates the dust being raised by the force of the blast, and in this case a greater weight of dust will permeate a given volume of air.—Editor.]

Yield of Fan under Increased Gage

Referring to COAL AGE, Jan. 11, 1913, p. 77, the question is asked: What quantity of air will a fan produce, at a constant speed, when the water gage is increased from 0.4 to 0.8 in., the original volume of air being 35,000 cu.ft. per min., under the lower gage? In answer to this question, it is stated that the volume of air is reduced to one-half of the original amount, or 17,500 cu.ft. per minute.

I beg to say that my experience in making many air measurements has proved that the same speed and efficiency of the fan gives the same quantity of air, regardless of the water gage against which the fan is operating. The yield of a fan is so much per revolution, up to a reasonable speed. The yield of the fan for a speed of 80 r.p.m. given in this question, is 35,000 ÷ 80 = say, 440 cu.ft. per revolution. The fan certainly will not produce less air per revolution because it is harder to turn; but it may take more power to produce the same speed under the increased gage.

In my experience, I have found that the quantity of air a fan will produce, at a normal tip speed, say a mile a minute, is proportional to the number of revolutions per minute. Thus, in this case, taking 440 cu.ft. per revolution as a base of calculation, this fan would yield as follows:

At	40	r.p.m.	17,600 cu.ft.
At	60	r.p.m.	26,400 cu.ft.
At	80	r.p.m.	35,200 cu.ft.
At	100	r.p.m.	44,000 cu.ft.

I know you will gladly correct this if the answer is in error.

JOSEPH VIRGIN.

Bancroft, W. Va.

[The experience of our correspondent is at variance with that of most fan engineers. By the terms of the question the water gage is increased and the speed of the fan remains unchanged. There are two ways in which the water gage in a mine may be increased; namely, by increasing the speed of the fan, or by an increase in the resisting power of the mine. Since the speed of the fan, in this case, is unchanged, the increase of water gage here must be due to an increase in the resisting power of the mine.

In practice, any increase in water gage due to an increase in the resisting power of the mine reduces the quantity of air in circulation in the mine and passing through the fan, for the same power on the air, according to the equation $U = Qp$.

As the pressure per square foot is increased, in the mine, as indicated by the water gage being increased from 0.4 to 0.8 in., or doubled, the quantity of air circulated by the same power is only one-half of the original quantity.

There is, however, under these conditions, a slight increase of efficiency in the fan. The quantity of air passing through the fan being less, the work lost in the fan is less, which increases its efficiency; and the effective power or the power exerted to turn the fan is increased, which makes the fan run faster, under the increased water gage. To maintain the same speed of fan, under these conditions, it will be necessary to reduce the power applied to the fan shaft.

Therefore, a slightly less power is required to produce the same speed of fan when, owing to the increased resisting power of the mine, the quantity of air in circulation is reduced. The ventilator, under these conditions, is more efficient; that is to say, a larger proportion of the power is made effective on the air. This is not to say, a larger volume of air is circulated per unit of power. The volume of air circulated per unit of power depends solely on the resisting power of the mine, which is independent of the ventilator, but controls the quantity of air circulated and the water gage.

The condition that our correspondent evidently has in mind is the increase of air volume due to an increase in the speed of fan, for the same conditions in the mine. In that case, it is true, approximately, that the volume of air is in proportion to the speed of the fan. Practically, the fourth power of the speed ratio is equal to the fifth power of the quantity ratio. In other words, the quantity increases in a slightly less ratio than the speed increases.—EDITOR.]

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The Miner's Certificate Law

I was pleased to see, in last week's editorial pages, the suggestion of Col. R. A. Phillips that the requirement of the present anthracite-mine law, demanding a two-years' citizenship of all miners before they could receive a miner's certificate, be dropped from the new law.

This requirement of the old law has debarred the better class of miners, from the soft-coal regions and the West, as well as from Wales, England and Scotland, from settling in the anthracite region. The result is that these men go West or South, or find their way into Canada, often reaching British Columbia. Others give up mining and go to farming. The anthracite-mine law, in this regard, has stopped the immigration into the anthracite field, of practically all the English-speaking miners, whose numbers are growing less and less, here, year by year.

Does any person of judgment think that any of these English-speaking miners from the old world are less qualified to receive a miner's certificate; or that an old experienced miner from the West or from the soft-coal regions, in any state, is not rightly entitled to stand an examination in the anthracite field of Pennsylvania, and, if successful, to receive a miner's certificate?

The conditions in the anthracite field, at the present time, call for a change in this law; so that any miner who has worked from two to ten years in any coal mine and gives his affidavit to this effect would be eligible for examination, and, if successful in passing the examination, should receive a miner's certificate, giving him the right to mine coal in the anthracite mines of Pennsylvania.

One of the baneful effects of the present law has been to almost depopulate some small towns and mining districts, and to close many English schools and churches. The English-speaking miners will not generally swear to an untruth, preferring rather to go back to where they came from than to labor for two years for men who probably know less of coal mining than themselves. I hope the commission appointed to revise the anthracite mining law will carry out Col. Phillips' suggestion and change the law in this respect. I was glad to know that the Wilkes-Barre Mining Institute recently voted unanimously in favor of the repeal of this portion of the law.

D. W. EVANS.

Wilkes-Barre, Penn.

INQUIRIES OF GENERAL INTEREST

M le Haulage in Mines

For some time past the driver bosses and firebosses, in our mine, have been discussing the question: Why is it that a mule or an electric locomotive cannot pull as great a load when attached to the car by a long chain or rope, say 10 or 20 ft. long, as when a shorter chain, say from 2 to 4 ft. in length, is used? We have agreed to submit this question to COAL AGE for their explanation.

CHARTER SUBSCRIBER.

Scranton, Penn.

Before attempting to answer a question of this kind, it is well to consider some of the conditions affecting problems of a similar nature. It is a matter of common observation that a mule, haulage engine or locomotive is able to haul a greater load, once started, than what the same power is able to start. It is well known that a trip of loaded cars is more easily started when loose chain or link couplings are used between the cars than when stiff couplings are employed. The obvious reason for this is that, in the first case, the load is started in sections or one car at a time, and it is necessary to overcome the inertia of a single car only; while, in the second case, the inertia of the entire loaded trip is opposed to the moving force, at the start.

A haulage engine often takes advantage of the slack in the haulage rope to start a heavy trip, which it can easily handle when once started, but the inertia of which is too great for the maximum steady pull the engine can exert. Experience has proved that a belt-driven fan runs smoother than one direct-connected, owing to the sag of the belt compensating largely for the irregularities of the engine and the load. For a similar reason, an air chamber is attached to a pump. The compression of the air in the chamber assists the action of the pump by maintaining a continuous flow of water in the discharge pipe, during the period when the pump is reversing its stroke. By this means, the pump is relieved of the burden of overcoming the inertia of the water column, at the beginning of each stroke; and water-hammer, in the pipe, due to the sudden arrest of the water, is avoided.

We have mentioned the foregoing conditions more for the sake of information and because of their indirect bearing on the question in hand. We understand the question asked by our correspondent relates to the ability of a mule to haul a greater load with a short chain than with a longer chain, after the load has been started. There are two conditions affecting the answer to this question: 1. The sag and swing of a long rope interferes with the steady pull necessary for the movement of the load and is annoying to the mule. 2. A short chain exerts a downward pull on the mule that enables him to maintain a firmer foothold on the road. When a short chain is used, the driver usually stands with one foot on the car and one foot on the chain, supp rting himself by placing one hand on the mule and holding to the car with the other hand. In this position, the weight of the driver, on the chain, exerts a compensating influence on the irregularities of motion between the mule and the car, which is similar to the effect produced in the operation of a belt-driven fan.

In reply to the question, therefore, we would suggest that the most important factor, in the use of a short chain, is the downward pull exerted on the mule, which enables him to maintain a better footing on the road and the compensating connection between the mule and the car, afforded by the driver standing with one foot on the short chain. The short chain also acts to steady and control the motion of the car. Moreover, the weight of the driver on the chain destroys the tendency of the pull to lift the car from the track.

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Extracting the Fifth Root

Will you kindly extract the fifth roots of 3 and 9, respectively, according to the method explained in COAL AGE, Sept. 7, 1912, p. 333.

ASSISTANT FOREMAN.

California, Penn.

Find two numbers whose fifth powers include the given number; the fifth power of the one being greater and that of the other less than that number. Thus, to extract the fifth root of 3, proceed as follows:

$$2^5 = 2 \times 2 \times 2 \times 2 \times 2 = 32 \text{ (high)}$$
$$1^5 = 1 \times 1 \times 1 \times 1 \times 1 = 1 \text{ (low)}$$

Since the given number, 3, lies between 1 and 32, its fifth root will lie between 1 and 2. Therefore, the required root is 1 plus a decimal.

To find the first decimal figure, proceed as follows:

$$2 \times 2 \times 2 \times 2 \times 1 = 16 \text{ (high)}$$
$$2 \times 2 \times 2 \times 1 \times 1 = 8 \text{ (high)}$$
$$2 \times 2 \times 1 \times 1 \times 1 = 4 \text{ (high)}$$
$$2 \times 1 \times 1 \times 1 \times 1 = 2 \text{ (low)}$$

The last product being less than the given number, add the several factors together and divide by 5. Thus,

$$\frac{2 + 1 + 1 + 1 + 1}{5} = \frac{6}{5} = 1.2$$

Therefore, the fifth root of the given number is 1.2, which is correct to the first decimal.

To find the second decimal figure, proceed as follows:

Divide the given number by the fourth power of the root thus far found, and add the quotient to four times the said root, and divide the sum by 5. The quotient will be the fifth root of the given number, to two decimal places. Thus,

$$\frac{3}{1.2^4} = \frac{3}{2.0736} = 1.447$$

$$\frac{(4 \times 1.2) + 1.447}{5} = 1.24$$

Therefore, $\sqrt[5]{3} = 1.24+$, which is correct to two decimal places.

The fifth root of 9 is found, in the same manner, and is $\sqrt[5]{9} = 1.37$.

EXAMINATION QUESTIONS

Power in Mining

Ques.—Define the term *power,* as used in mining.

Ans.—As used in mining, the term *power* relates to the rate at which mechanical energy is exerted. Power is exemplified by a given force acting through a given distance in a given time; or a given force moving at a given rate of speed or velocity. The expression of power, therefore, depends on three elements or factors; namely, force, distance and time.

Ques.—What is a horsepower?

Ans.—A horsepower is an adopted standard for the measure of power. It is the power exerted when a weight of 33,000 lb. is lifted through a vertical distance of one foot in one minute. This power is expressed as 33,000 ft.-lb. per min. The same power (one horsepower) is exerted when a weight of 330 lb. is lifted through a vertical distance of 100 ft. in one minute, or 10 ft. in six seconds; or a weight of 55 lb. lifted 10 ft. in one second. The same rate of work is performed, per unit of time, and the same power exerted, in each case.

Ques.—Explain the difference between work and power.

Ans.—Work is performed when a force is exerted through a given distance, irrespective of time or velocity. Power is exerted when that work is performed in a given time. Power is work performed per unit of time. Work is expressed in foot-pounds, while power is expressed in foot-pounds per minute or per second.

For example, 100 lb. lifted through a vertical distance of 10 ft.; or 10 lb. through a distance of 100 ft.; or 1 lb. through a distance of 1000 ft.; represents a certain work performed, which is expressed by *1000 ft.-lb.* To perform this work in one minute will require ten times the power necessary to perform it in 10 min.; thus it requires a greater power to perform the same work in less time, the power varying inversely as the time.

Ques.—Disregarding friction, what power is required to hoist 100 tons of coal per hour, from a shaft 500 ft. deep?

Ans.—The work performed, in this case, is

$$100 \times 2000 \times 500 = 100{,}000{,}000 \text{ ft.-lb.}$$

This work is performed in one hour. The work performed per minute, or the power exerted, is, therefore,

$$\frac{100{,}000{,}000}{60} = 1{,}666{,}666+ \text{ ft.-lb. per min.}$$

This corresponds to a horsepower of

$$\frac{1{,}666{,}666}{33{,}000} = 50.5 \text{ hp.}$$

Ques.—Disregarding friction, what horsepower will be required to pump 300 gal. of water per minute, from a shaft 400 ft. deep?

Ans.—The weight of 1 gal. of water is practically 8⅓ lb. The weight of water lifted is, therefore, in this case,

$$300 \times 8\tfrac{1}{3} = 2500 \text{ lb. per min.}$$

The work performed in raising this water 400 ft. is then

$$2500 \times 400 = 1{,}000{,}000 \text{ ft.-lb.}$$

Since this work is performed each minute, the required effective horsepower is

$$\frac{1{,}000{,}000}{33{,}000} = 30.3 \text{ hp.}$$

Ques.—A boiler is to be run under a pressure of 100 lb. to the square inch; to what hydrostatic pressure should this boiler be subjected in order to test its safety?

Ans.—The hydrostatic test is not applied to boilers to determine the degree of safety. It is applied for the purpose of showing any leaky joints or revealing other structural defects in the workmanship. For this purpose it is customary to subject a new boiler to a hydrostatic pressure 50 per cent. in excess of the proposed working pressure. For a working pressure of 100 lb. per sq.in., a new boiler should be subjected to a hydrostatic test of, say, 150 lb. per sq.in.

To determine the safety of a boiler it must be subjected to a rigid inspection by a competent man, and must fulfil the requirements determined by a computation based on the strength of the material and manner of construction of the boiler. To subject a boiler to a hydrostatic test exceeding 50 per cent. of the proposed working pressure would, generally, strain the parts of the boiler and weaken its condition. The hydrostatic test is regarded as a test of workmanship, rather than a test for safety.

Ques.—Explain the advantage of a duplex over a single hoisting engine, in mining.

Ans.—A duplex engine is one having two cylinders. In such an engine, the cranks on the main shaft are set at right angles to each other, so that the engine has no "dead center." This is an important feature in a hoisting engine, in mining, where it is necessary that the engine shall be able to start promptly and pick up its load without difficulty. This cannot be done with a single engine if the crank happens to be on dead center, or near that point. In hoisting practice, it is customary to calculate the size of the engine required to perform a certain work, on the basis of a single cylinder. This always gives an excess of power, which is important in hoisting.

Ques.—For what reason should a boiler have a good water circulation?

Ans.—The principal reason for this requirement is to provide an even distribution of the heat throughout the bulk of the water, in the boiler, and thus accomplish a more uniform generation of steam and avoid likewise any unnecessary strain on the parts of the boiler due to alternate expansion and contraction arising from a change in temperature. In other words, a good water circulation maintains a uniform condition in all parts of the boiler.

Ques.—What weight of coal, per horsepower per hour, will be required in operating a tubular boiler, in common coal-mining practice?

Ans.—In mining practice, an ordinary tubular boiler will require from four to six pounds of anthracite, or from five to seven pounds of bituminous coal, per horsepower per hour, depending on the quality of the coal and the manner of firing.

COAL AND COKE NEWS

Washington, D. C.

The Senate has passed a bill extending the time for the survey, classification and appraisement of the surface of the segregated coal and asphalt lands of the Choctaw and Chickasaw Nations in Oklahoma, which contains the following provisions among others:

That the act of Feb. 19, 1912 (Thirty-seventh Statutes at Large, page 67), as amended and supplemented by Section 18 of the act of Aug. 24, 1912 (Thirty-seventh Statutes at Large, page 518), is hereby amended to provide that the survey, classification, and appraisement of the surface of the segregated coal and asphalt lands of the Choctaw and Chickasaw Nations shall be continued in the manner prescribed in said acts, except as otherwise provided herein, and shall be completed not later than eight months from the date of the approval hereof, such appraisement and classification to be made by the appraisers appointed by the President Nov. 25, 1912, or by their successors in office, at a compensation of not to exceed $15 per day each, with allowance for actual and necessary expenses, including transportation, not to exceed $5 per day each, to be determined by the Secretary of the Interior.

Sec. 2. That said survey, classification, and appraisement shall be made under such regulations in such manner as may be prescribed by the Secretary of the Interior, and the disposal of said lands, including purchases by holders of coal or asphalt leases, may be proceeded with when and as the appraisement of the several tracts shall be completed.

A bill reading in part as follows has been introduced in the House by Representative Foster and referred to the Committee on Public Buildings and Grounds:

That the Secretary of the Interior be, and he is hereby, authorized and directed to enter into a contract or contracts for the erection and completion of fireproof laboratories and other buildings suitable and necessary for the investigations of the Bureau of Mines, on a site hereinafter provided, in the city of Pittsburgh, Penn., within the total limit of cost hereinafter fixed.

That the said laboratories and other buildings shall be constructed under the supervision of and in accordance with plans and estimates to be approved by a board consisting of the Supervising Architect, the Chief of Engineers of the Army, and the Director of the Bureau of Mines, and shall be so constructed as to cost, complete, with the necessary railroad sidings, approaches, plumbing, lighting, heating, ventilating and hoisting apparatus, and other necessary appurtenances, not to exceed the sum of $500,000, of which amount the sum of $300,000 is hereby appropriated and shall be immediately available for the preparation of plans for said laboratories and other buildings and for carrying forward construction work; and the Secretary of the Interior is hereby authorized to employ, without regard to civil service laws or regulations, and to pay for, out of this appropriation, such architectural or other technical services as may be recommended by the above board to aid in the preparation of the plans and specifications and to supervise the construction work herein provided for.

Concerning Alaska Coal Lands

Senator Jones, of Washington, has offered the following bill in the Senate relating to the establishment of coal-land titles in Alaska:

That every person who located or entered, or attempted in good faith to locate or enter, any coal land in Alaska under the coal-land laws of the United States prior to Nov. 12, 1906, and whose location or entry thereof has been suspended, contested, denied or canceled by the United States, is hereby authorized, at any time within one year from the date of the approval of this act, to bring a suit in equity against the United States, in any court of competent jurisdiction in the district where the land is situate, to quiet his title thereof; and if, upon the trial of such cause, it shall be found by the court upon the evidence that the said locator or entryman had complied with the coal-land laws of the United States up to the time of the suspension, contest, denial, or cancellation of his location or entry, such location or entry shall be reinstated by order of the court, and the locator or entryman may thereupon complete said entry by making the proof required to the court.

A bill of similar character has been offered in the House by Delegate Wickersham, of Alaska, but this measure contains the following proviso in addition to the main text:

That either the locator or entryman so bringing said suit or the United States may appeal said cause in the manner provided by the laws relating to appeals from said court; that if the final decree of the said courts shall be in favor of the said locator or entryman a patent shall be issued in the usual form, conveying the said land to the said locator or entryman; that if the final decree of said court in said cause shall be in favor of the United States, the said locator or entryman shall be held to have no right to or equity in said land, and his location or entry shall be canceled and held for naught.

WILKES-BARRE, PENN.

Three men were buried beneath a rush of coal and rock in the East Lehigh Colliery, at Tamaqua. A 15-ft. gangway leading to the place where the men were working is filled for several feet with caved material, and several days will probably be required to reach the men. Nine men were entombed in this mine three weeks ago, eight of whom were rescued after being imprisoned for 40 hours.

Anthracite Strikes

Strikes are on at four collieries in the anthracite-coal region. In Nanticoke nearly a thousand men are out of work as a result of a dispute between the workers and the Susquehanna Coal Co. The men claim that the company ordered representatives of the union off the company's property, and they are determined that this action shall be repealed. Until it is they say they will remain idle.

The breaker hands at the West End Colliery are on strike at Mocanaqua. The trouble arises from the time of blowing the first whistle in the morning. The first whistle is not blown until 7.15, and the men and boys are not paid for the extra quarter of an hour.

At the Lytle and Pine Hill Collieries, both subsidiary interests of the Pennsylvania R.R. Co. west of Pottsville, the rockmen have gone on strike. They claim they are not receiving the full wages decided by the agreement entered into between the miners and operators last spring. A request for an increase of 10 per cent. has been refused by the company.

The Meeting of the Conciliation Board

At a meeting of the conciliation board, held in Wilkes-Barre, the Lehigh & Wilkes-Barre Coal Co. was ordered to pay its contract miners 61c. per yard for cutting top clod 4 in. and over in thickness. The company claimed that they were supposed to pay only when the thickness exceeded 6 in. All back claims are also to be paid to the men. The same company agreed to have two kinds of explosives at the Lance Colliery for the men to determine which is the better for their work.

The employees of the No. 7 Colliery of the Susquehanna Coal Co., who have been on strike because the company refused to allow the grievance committee to examine the union buttons of the men, were ordered back to work. The board has never made a ruling on this question, and it was decided that the men should return to work, and present their case in a proper form at a later date.

The grievance of the contract miners of the Hollenback Colliery of the L. & W. B. C. Co. was ordered sent to the umpire by President Dempsey. The miners want 20c. per foot for mining rock, and the company offered 13c. The umpire will decide the question. Relative to the grievance of the employees of the South Wilkes-Barre Colliery of the L. & W. B. C. Co., the board decided to take further testimony, and probably render a decision at the next meeting.

The contract rock miners of the Laflin Colliery of the D. & H. Co. presented a grievance in which they declared that they received only a 5 per cent. increase following the recent award, though the coal miners received the full 10 per cent. The case will be given further attention by the board at the next meeting. A grievance was presented by the contract miners of the Seneca Colliery of the L. V. C. Co., at Pittston. The men ask 50c. per foot for removing rock and bone. The miners from the Drifton district ask for 61c. a foot for removing impurities in the vein. These cases will also be discussed further at the next meeting.

Mine Caves

Wilkes-Barre and Scranton have been the scenes of serious mine caves during the week. Twenty houses were damaged in West Scranton by a surface disturbance caused, it is claimed, by a cave in the workings of the People's Coal Co. The cave affects properties on Lafayette St. to Price, North Main St. and North Hyde Park Ave.

The workings of the Hillside Coal & Iron Co., at Cork Lane, Pittston, settled and caused considerable damage, affecting several houses and breaking the water pipes of the Spring Brook Water Co. Officials of the company have warned the residents to be on the lookout for more caves as the workings are still settling.

Fully a score of houses on North Pennsylvania Ave. and Wyoming St., between Chester and Ralph Sts., in Wilkes-Barre, were damaged by a surface disturbance caused by mining operations at the Dorrance Colliery of the L. V. C. Co. The majority of the properties are not affected seriously.

PENNSYLVANIA

Anthracite

Seminole—There was a strike at the Shawmut mine a short time ago and no coal vas mined for a period of four days. The disagreement is said to have arisen from the fact that some of the employees were working longer hours than prescribed by the union. The matter has been settled, however, and the men have returned to work.

Tamaqua—Little hope is entertained by the rescuers at the East Lehigh colliery for the safety of the three men entombed Jan. 22. It is believed that they were caught in the fall of top rock and killed instantly. The character of the débris which must be removed indicates that it may be a week before the bodies will be reached.

Harrisburg—The State Railroad Commission has recommended that the rate per ton for coal from the Clearfield region to Lancaster and points between Harrisburg and Lancaster should not exceed $1.40 per gross ton. This ruling was made in the complaint of the Manufacturers Association of Lancaster against the charges made by the Pennsylvania R.R. on bituminous coal.

Fredericktown—The bursting of a flywheel on a generator engine at the mines of the Clyde Coal Co. resulted in the total wrecking of the generator and serious damage to the building. A large piece of the wheel tore a hole in the roof and smaller fragments tore through the wall. The generator supplied light and power to the mines, and as a result of the accident these latter will have to be shut down. The cause of the accident is unknown.

Nanticoke—Seventeen men had a narrow escape from death at the No. 4 Slope of the Susquehanna Coal Co. at Nanticoke, when a trip of three cars in which they were riding to the surface broke loose and ran down the slope. Seven of the men were injured, three seriously. The accident was caused by the rope, in some unknown manner, becoming detached from the cars as they were ascending a slope about 4500 ft. in length. The cars were derailed after traveling downward about 200 ft., and the ten men who remained in the cars were injured considerably less than the seven who jumped from the trip when they discovered their danger.

Bituminous

Charleroi—Five hundred miners employed in the Jumbo mine of the Pittsburgh Coal Co., near McDonald, have gone on strike because the company officials refused to discharge three nonunion men employed at the mine.

WEST VIRGINIA

Charleston—District No. 17 of the United Mine Workers wound up its convention here by the passing of resolutions denouncing a martial law regime.

ALABAMA

Birmingham—The Alabama Consolidated Coal & Iron Co.'s Searles Mine, which has been idle for several months, will be put into operation at once. The entire output of approximately 1000 tons per day has been sold to the Tennessee Coal, Iron & R.R. Co., and will be made into coke in their new by-product ovens at Corey.

OHIO

Coshocton—Thirty miners, who were entombed in the Tyndale mine No. 1 of the Columbus Coal & Mining Co., have been rescued through the airshaft. Several of the men were faint from exhaustion and foul air.

Columbus—A hearing on the merits and demerits of the antiscreen bill, which provides that miners must be paid on the mine-run rate in the Buckeye State, will be held during the coming two weeks before the Senate committee on mining. The bill which was introduced in the Ohio legislature by Senator Green is bitterly opposed by operators in every mining section of the state. The passage of the bill will mean a long fight between miners and operators Apr. 1, 1914, when the present mining scale expires.

Operators gathered at Dennison, Ohio, recently and claimed in case the bill became a law all of their operations which are valued upward of $2,000,000 will be dismantled.

INDIANA

Princeton—The Princeton Coal Co.'s mine has been shut down until fans can be installed at the bottom of the air shaft. The mine, worked at 440 ft., is one of the deepest in the state. Two hundred miners are employed.

Terre Haute—Fifteen hundred miners who struck in the Clinton field, returned to work, pending negotiations by their officials for redress of their grievances, chief of which was alleged unsatisfactory train service to and from the mines.

FOREIGN NEWS

Germany

Berlin—In Haselbach, near Altenburg, a burning subterranean coal deposit has just been discovered. The whole town stands above the burning coal field. For some time several of the larger houses of the place had to be repaired because of the mysterious cracks in the walls. Finally the architects decided to drill into the ground to ascertain the cause. They came upon the burning coal field less than seven yards under the surface.

PERSONALS

W. M. Whitmore, a coal dealer of Dayton, O., is seriously ill at his home.

John P. White, of Oskaloosa, Ia., president of the United Mine Workers of America, has been reëlected president of the organization over A. Bradley, of Mt. Olive, Ill. Frank J. Hayes, of Collinsville, Ill., was reëlected vice-president. He had no opposition. Edwin Perry, of Oskaloosa, Ia., was reëlected secretary-treasurer by a large majority. On the auditing and credentials committee John J. Mosson, of North Lawrence, Ohio; Albert Neutzling, of Glen Carbon, Ill., and William Dondaldson, of Dubois, Penn., were elected. Three tellers were elected: William Young, South Fork, Penn.; Thomas Paskell, Shawnee, Ohio; Thomas Holiday, Granville, Ill. Twenty-one candidates were in the race for delegates to the American Federation of Labor. The following were elected: John P. White, John Mitchell, Spring Valley, Ill.; Frank J. Hayes, Collinsville, Ill.; John H. Walker, Springfield, Ill.; William Green, Coshocton, Ohio; Duncan McDonald, Springfield, Ill.; Adolph Germer, Belleville, Ill. The newly elected officers will be installed early in February.

BOOK REVIEW

ANNALES DES MINES DE BELGIQUE—Tome XVII 4-me livraison, 1912. 366 pp., 6¼x10 in. Paper. L. Narcisse, 4 rue de Presbytère, Brussels.

This section of the government mining annual contains "The Iron Ore Problem in Belgium," by A. Delmer, "The Coefficient of Safety of Hoisting Ropes," by F. Herbst, republished from "Gluckauf," "Ankylostomaisis in the Sicilian Sulphur Mines" from the "Rassegna Mineraria," "General Rules for the Use of Electric Machines and Transformers (except Locomotives) Adopted by the Belgian Committee of Electro-Technology, Session of Feb. 20, 1912."

This is followed by the statistical section, relating to the mining and metallurgical industries and to boilers, engines, etc. Reports are made on underground haulage by storage-battery locomotives, mechanical coal cutting, lining a shaft with reinforced concrete, safety forms used during shaft sinking, a method of hauling excavated earth from a spoil pit for use in flushing, a bucket for removing earth, installation of electric signals at shafts and Nellen's elastic metal mine posts. The book is completed by a series of cross-sections of strata in the Hainault coal basin.

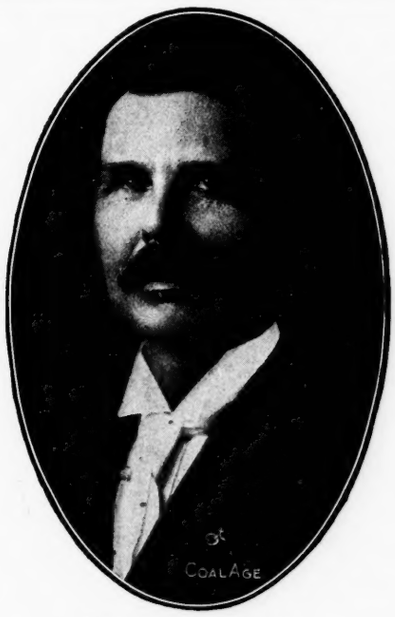
PUBLICATIONS RECEIVED

FIRST ANNUAL REPORT OF THE STATE MINE INSPECTOR OF NEW MEXICO, FOR THE YEAR ENDED NOV. 30, 1912. By Rees H. Beddow, state coal mine inspector, Gallup, New Mexico. Paper, 6x9 in.; 35 pages.

The report is the first made under the law regulating the operation of mines for New Mexico, approved June 13, 1912, and made operative 90 days later. Rees H. Beddow was appointed the first state coal mine inspector, succeeding Jo. E. Sheridan, who was mine inspector under the federal government.

The report is a brief summary of the 52 coal mines in the state, 33 of which reported to the mine inspector, 16 failed to make any report and three other mines are reported not working. Beside the usual statistical tables, the report contains a brief summary of mine inspections made by former Mine Inspector Sheridan, from July 15 to Oct. 30, 1912. The report also contains the New Mexico mining law.

OBITUARY



EDWARD L. WOLFORD

Edward L. Wolford, probably one of Indiana's most prominent coal miners, died at his home Jan. 12. A strange coincident arises in the fact that his death occurred within a few hundred feet from the spot where he was born July 7, 1861.

The history of his life is interesting. After receiving his early education, Mr. Wolford was attracted by the mining business in the locality of Linton, Ind. His executive ability soon drew attention to himself as a wizard in organization and development.

In 1892 he entered the Island Valley Coal & Mining Co., acting as treasurer until the business closed out. His next position was that of secretary of the South Linton Coal Co., of which concern he was also a prominent stockholder and general manager.

Mr. Wolford was one of the original promoters and organizers of the Black Creek Semi-Block Coal Co., and was secretary-treasurer of this company until the time of its merger in 1906. When the Linton Coal Co. was organized Mr. Wolford became general manager. Later in the organization of the United Fourth Vein Coal Co., he demonstrated his keen executive ability and won for himself the respect of all in the coal mining business.

Through the achievements of Mr. Wolford this company effected the consolidation of 6 other companies, together with itself, at a capital stock of $1,000,000. Mr. Wolford became president and general manager of this concern and remained in that capacity until the time of his death.

He is survived by three sons and a daughter.

CONSTRUCTION NEWS

Johnstown, Penn.—The Fallen Timber Coal Co.'s new tipple is almost completed and it is expected that coal will be shipped within a few days. The company will employ about 150 men.

Rankin, Ill.—The new $12,000 coal dock, of the L. E. & W., is now completed. It is built entirely of steel and is run by a 12-hp. gasoline engine. It is the only one of its kind on the system.

Miller Grove, Ill.—The new coal chutes which were being erected by the Fairbanks Morse Co., at a cost of $45,000, have been completed and the machinery for hoisting the coal has been installed. This newest chute is said to be the best of its kind on the Frisco System.

Duluth, Minn.—Various coal companies at the head of the Lakes are making preparations for the enlarging of their coal docks and many contracts have already been let for the same. A contract has been let recently for a new dock for the Berwind Fuel Co., which will have a capacity of 800,000 tons.

Townsend, W. Va.—A large power plant is now in the course of construction on the south side of the Kanawha, at Cabin Creek Junction. The foundation has been laid and practically all the frame work is complete. The West Virginia Power Co. is said to be the chief company promoting the new enterprise.

Morgantown, W. Va.—A company of Ohio coal operators is preparing to open up a tract of 140 acres of the Pittsburgh seam of coal just below Lowsville, together with a 90-acre tract of the Sewickley coal at Rivesville, along the Buchanan & Northern R.R. An uptodate mining plant is being installed at Watts, and it is reported that the Ohio firm will mine the coal on a royalty basis.

Franklin, Penn.—The Pennsylvania Southern R.R. proposes to construct eight miles of new track, which will cut the distance between Franklin and Clarion from 60 to 39 miles. Valuable coal deposits are being developed along this line, and it is stated on good authority that a new coal company, having 2000 acres of the best coal land in Clarion County, is being organized, with offices in Franklin.

Scottdale, Penn.—It is expected that the Hecla-Baggaley line of the West Penn Railways Co. will be completed by June 1. Most of the lesser surface grading has been done and work on the larger cuts has been started. Steel for the bridges is being delivered and ties and rails have been ordered. This road will furnish train service for nine coke towns, with a population of 15,000 or more, which are now virtually cut off.

Pittsburgh, Penn.—It is rumored that within the next three years 10,000 new coke ovens will be built in this territory, to meet the constantly increasing demand for coke from the Connellsville region. A secondary purpose is said to be to offset the number of ovens that have been abandoned because of exhaustion of coal in that region.

The Pittsburgh-Buffalo Co. has planned for 250 new ovens near Marianna, and the Pittsburgh-Westmoreland Coal Co. is contemplating the addition of many hundred ovens in its 20,000-acre holding.

NEW INCORPORATIONS

Henryetta, Okla.—The Summers Coal Co.; capital stock, $50,000; to develop coal lands.

Knoxville, Tenn.—The Hickory Creek Coal Co., capital stock, $30,000; to develop coal lands.

Ottumwa, Ia.—The Trio Coal Co.; capital stock, $10,000; to mine and sell coal and operate coal mines.

Middlesboro, Ky.—The Mingo Coal Co.; capital stock, $1500. Incorporators: John Reese, Mollie Reese and Mossie Reese.

Williamsburg, Ky.—The Bank Coal Co.; capital stock, $6000; to purchase or lease coal lands and engage in operating.

St. Louis, Mo.—The Briquette Coal Manufacturing Co.; capital stock, $100,000. Incorporators: J. Carlton O'Neal, D. E. O'Neal and Virgil Turpin.

Phoenix, Ariz.—The Black Pine Mining Co.; capital stock, $1,000,000; to deal in coal and the byproducts thereof, together with other minerals.

St. Louis, Mo.—The Ratican Coal & Contracting Co.; capital stock, $10,000. Incorporators: I. C. Muckerman, Wm. Ratican and P. J. Ratican.

Kansas City, Mo.—The V. McDaniel Fuel Co. has been incorporated here, with a capital of $4000, by V. McDaniel, G. L. Stauffer and Charles Hayward.

Bloomington, Ill.—The Meadow Grain & Coal Co.; capital stock, $12,100; to deal in grain and coal. Incorporators: John Streid, Andrew Baller, and Emanuel Oyer.

Franklin, Penn.—Application will be made by George C. Miller, Dennie D. Mallory, Gordon F. Proudfoot, John B. Moorhead and James S. Carmichael. Pensy Coal Co.

Austin, Tex.—The Libby Manufacturing Co.; capital stock, $50,000; to mine and sell lignite coal. Incorporators: L. C. Libby, W. H. Seay, P. M. Fleming. Principal office at Mount Pleasant, Titus County.

Scranton, Penn.—Charters were granted by the state department in Harrisburg to the Noble-Williams Coal Co. and the George D. Fuchs Co., both incorporated by Scranton men and both capitalized at $5000.

Cleveland, Ohio—The Balkan Mining Co., mining and dealing in iron ore and coal, etc.; capital stock, $300,000. Incorporators: G. W. Cottrell, C. G. Roads, I. L. Evans, Henry G. Dodge and Gustav von den Steinen.

Hamilton, Ohio—The Hamilton-Otto Coke Co., of Hamilton, Ohio, has been incorporated with a capital stock of $700,000, to mine and deal in coal and coke. The incorporators are J. C. Thomas, E. M. Peters, E. C. Seimer, John W. Linfert and Robert Ramsey.

Fairmont, W. Va.—The Karnak Coal Co.; capital stock, $150,000; to develop coal and other mineral lands in Pawpaw district, Marion county. Incorporators, David Morrison, J. W. Hayward, C. T. Porter, and G. D. Ewert, of Cleveland, O., and M. T. Porter, of Lakewood, O.

New York, N. Y.—The Socorro Mining & Milling Co.; capital stock, $2,000,000; to engage in all kinds of mining. Incorporators: J. L. Kauffman, B. Abbott, C. E. McMahon, M. A. Lynch, and G. H. Fitzgerald. Principal offices at 165 Broadway, and chief works to be located in Socorro County, New Mexico.

Sugarcreek, Ohio—The Sugarcreek Clay Product Co., of Sugarcreek, Ohio, has been incorporated with a capital stock of $40,000, to mine and deal in clay, coal and brick and other clay products. The incorporators are Amra Hotchstetler, J. M. Hotchstetler, E. E. Weaver, W. B. Hochstetler, and J. F. Zahner.

Charleston, W. Va.—The Thomas Coal Co.; capital stock, $50,000; the production and selling of coal, oil and timber. Incorporators: D. C. Thomas, Classton, Penn.; J. W. Blower and E. B. Graham, of Columbus, O.; L. G. Worsten and H. D. Wilson, of Atherton, O. The principal office and chief works are at Seng, Logan county.

Joplin, Mo.—A company was organized here comprised of Webb City and Oklahoma mining operators for the purpose of drilling virgin land north of Hattonville, Okla. A lease on 500 acres near that city was taken by A. D. Hatten, a local operator. Local members of the company, A. D. Hatten, T. F. Coyne, and A. J. McInturff, will leave in a few days for their property near Hattonville.

INDUSTRIAL NEWS

Connellsville, Penn.—A New York syndicate has purchased 30,000 acres of coal in Macoupin County, Illinois, for $600,000.

Harlan, Ky.—The Harlan Coal Mining Co. is reported to have sold to the Clover Fork Coal Co. a tract of about 500 acres of land.

Somerset, Penn.—Lloyd G. McCrum has opened the Operator's Special Agency for coal and coke trade in the Shafer Block, Somerset, Penn.

Cantine, Ill.—The washer of the Lumaghi Coal Co., of St. Louis, which was recently destroyed by fire, with a loss of $50,000, will be rebuilt at once.

Chicago, Ill.—The fifth conference of the Western Electric prize salesmen at Hawthorne was held at the Hotel LaSalle during the week of Jan. 6.

Birmingham, Ala.—Margaret No. 3, the new mine being opened up by the Alabama Fuel & Iron Co., at Margaret, Alabama, will be ready to ship coal by Feb. 1.

Holden, W. Va.—The U. S. Coal & Oil Co. will add to the equipment of its mines six 6-ton electric mining locomotives, which have been ordered from the General Electric Co.

Windber, Penn.—The Berwind-White Coal Mining Co. has ordered a 4375-kv.-a. Curtis turbo-generator, which will be furnished and installed in the company's power plant by the General Electric Co.

Cresson, Penn.—The Pennsylvania Coal & Coke Corporation will install in the power plant two 345-kv.-a., 2-unit, 3-motor-generator sets and switchboards recently ordered from the General Electric Co.

Charleston, W. Va.—The mine of the Lewis Coal Co., at the mouth of Cabin Creek, which has been idle since Apr. 18, has resumed operation, giving employment to about 500 miners and mine laborers.

Fairmont, W. Va.—The Consolidation Coal Co. will equip its collieries at McRoberts, Ky., with five 10-ton 42-in. gage electric mining locomotives. The order for these machines has been placed with the General Electric Co.

Hooversville, Penn.—Washington Custer, a prominent farmer living in Shade Township, has disposed of the coal under a large tract of land to the Loyalhanna Coal & Coke Co., which is establishing a new mining town near Reitz.

Colver, Penn.—The Ebensburg Coal Co. has arranged to add to its power-plant equipment a 500-kw. rotary converter, three 185-kv.-a. and three 75-kv.-a. transformers, and switchboard apparatus. The equipment will be furnished by the General Electric Co.

Williamsburg, Ky.—The Appalachian Ry. Co., of Knoxville, Tenn., has started the actual work of surveying the line which it proposes to construct from Williamsburg, Ky., to Petros, Tenn., a distance of about 60 miles, for the purpose of giving it access to a rich coal section.

Birmingham, Ala.—The byproduct coke-oven plant of the Tennessee Coal, Iron & R.R. Co., at Corey, is now manufacturing 3000 tons of coke daily. H. M. Urban has been appointed assistant general superintendent of the byproduct coke-oven plant to succeed H. R. deHoll, who goes with the Inland Steel Co., at Chicago.

New York, N. Y.—At a recent meeting of the Executive Committee of the American Museum of Safety, it was unanimously decided that the "Scientific American" gold medal for the most efficient safety device invented during the last three years, and exhibited at the Museum, should be awarded to the Draeger Oxygen Apparatus Co.

Pittsburgh, Penn.—The Rochester & Pittsburgh Coal & Iron Co. will add to its power-plant equipment at Punxsutawney, Penn., two 300-kw. rotary converters, two 75-hp. and two 100-hp. motors, three 75-kw., six 110-kw. and one 200-kw. transformers, and switchboard apparatus. All this material has been ordered from the General Electric Co.

Hazard, Ky.—The first large operation in Perry County field is being rapidly opened up by the Kentucky Jewel Coal Co., which has leased from the Slemp Coal Co., a good-sized boundary for immediate development. The exact location of the new plant is one mile east of Hazard, and it will be designed to handle a daily output of 800 to 1000 tons.

Jackson, Ky.—The extension of the Louisville & Nashville R.R. from Jackson, up the North Fork of the Kentucky River, has opened up a heretofore entirely undeveloped and valuable coal territory.

Up to date, there are no operations in this field, but from now on it is expected to be a factor in the coal business.

Chicago, Ill.—The Consolidated Indiana Coal Co. announces that Frank Ragan has been appointed general sales agent of the company, with headquarters at 139 West Van Buren St., Chicago. Customers and the coal trade are requested to send their orders and inquiries to Mr. Ragan.

Wilkes-Barre, Penn.—During the past week the Auchincloss colliery of the D., L. & W. Coal Co. broke the colliery record for the number of tons of coal loaded for transportation. The previous record was 1156 tons, but the new one is 1226 tons of prepared coal. This is an excellent record for an experimental colliery like the Auchincloss.

Roundup, Mont.—Coal of a very fine quality has been discovered by John Davis on Horse Thief Creek. The coal seam extends over an 80-acre tract belonging to M. M. Klein, and is all very convenient for loading cars on the spur. A shaft 100 ft. in depth has already been opened, and an operating mine will be opened as rapidly as possible on the Klein and Davis properties.

Charleston, W. Va.—The New River Pocahontas Consolidated Coal Co. will equip its collieries with new electrical apparatus consisting of an 850-kv.-a., 3-unit, 4-bearing motor-generator set, a 435-kv.-a. motor-generator set, a 380-hp. motor, and an electric hoist with control equipment, air compressor and switchboard. All the apparatus will be furnished by the General Electric Co.

Hazard, Ky.—The Kentucky Jewel Coal Co. has leased about 500 acres of valuable coal land from the Slemp interests, and has started on the construction of a $50,000 plant, from which they expect to be shipping from eight hundred to a thousand tons per day, by early fall.

H. E. Bullock, who has made a success in the Jellico field, will give his personal attention to the construction and operation of the plant here. The plans, as formulated, call for a modern plant, using only the best and most scientific methods of mining.

Miike, Japan—Some Koppers coke ovens similar to those employed at Gary, Ind., have been erected at Miike by the Mitsui Busan Kaisha to deal with coal dust, which has hitherto been wasted. The capacity of the plant, says the London "Times Engineering Supplement," is 300 tons of dust at one charge, and the time of coking is 26 to 28 hr. One ton of the dust is stated to produce 10,000 cu.ft. of gas, 65 to 70% of coke, 6% of coal tar, and 1 to 1.3% of sulphate of ammonia. Part of the gas produced is to be used in large gas engines for the generation of electricity. Current will also be supplied from this source for the lighting of the towns of Omuta and Miike.

COAL TRADE REVIEWS

GENERAL REVIEW

Cancelations of orders for anthracite are being received in such numbers as to cause some anxiety among the companies. There is considerable coal moving, and while there is nothing as yet to indicate that any is going into storage, a continuation of the prevailing unseasonable weather conditions is liable to make such a disposition necessary in the near future. Domestic consumers have certainly effected a great economy in fuel so far this year, but February and March of the last two years saw a heavy consumption, and there are still possibilities of the market assuming rather grave proportions yet. However, conditions have been even more favorable than the most optimistic of the anthracite producers had dared hoped for, and it is hardly possible that there will be any real distress during the remainder of the season. The trade is showing a direct reversal of form, and a dullness more characteristic of June and July.

There seems to be plenty of bituminous coal for prompt loading in the Eastern coastwise trade, and the market has shown a tendency to soften still further. Buying is limited and confined mostly to the largest consumers, small buyers appearing confident that the market will ease off still further. The more popular grades are beginning to come through as the pressure is released, and the prospects are conditions will shortly be more normal. There are rumors of contracts at 15c. above last year's figures, but buyers as a rule are holding off pending more settled conditions.

Eastern dealers generally are holding firm on the prevailing high prices, appreciating the fact that once they ease off it will be difficult to restore them. In spite of their best efforts, however, slight reductions have occurred, and more will undoubtedly follow in rapid succession, unless more seasonable weather appears. There are considerable unsold tonnages at some points, and buyers are showing a total lack of interest in the market. Prompt shipment is obtainable in the Pittsburgh district at practically contract prices, with the exception of slack, which brings a small premium; the manufacturing demand here has been somewhat less than was expected.

The unseasonable weather has had a disastrous effect upon the trade in Ohio, and the shortage caused by the recent flood is probably the only thing that has prevented a violent break. The domestic market is particularly weak, while the steam grades are fairly strong, but showing a tendency to act in sympathy with the domestic. At Hampton Roads the continued warm weather, good loading at the mines, and prompt movement by the railroads have softened the market, and prices are again off; however, contract prices for the new year are fairly well established at 15c. over the prevailing circular. There is a good healthy demand for the steam grades in the South, while the domestics are rather weak, but the mines are making record productions.

Quietness prevails throughout the Middle Western market, small tonnages are being taken on contract, and a number of mines are shutting down. There is less coal being bought than was ever known in January, retailers appear to be heavily overstocked, and the only redeeming feature of the trade is the steam business.

BOSTON, MASS.

The market continues to soften and prices are still lower. At Hampton Roads there seems to be plenty of coal for prompt loading, and there is only a limited amount of buying on the part of corporations and contractors who are still behind on their requirements. Pocahontas and New River are reported to have sold at less than $3 f.o.b. for shipment in the next fortnight or so, several of the shippers having quietly placed a moderate volume of coal. The business for the moment is confined to the largest buyers, for none of the smaller plants appear to have enough confidence in either a reversal of weather conditions in February or in any higher prices than are currently quoted to justify taking on fuel for more than a month or so ahead.

For inland distribution, contracts are rumored to have been closed at 15c. higher than the delivered price for last year and extending to Apr. 1, 1914. The feeling is, however, that buyers are going to be diffident about entering the market until the season is far enough advanced to show a more settled outlook.

There continues to be serious interruption in all-rail deliveries from certain districts because of floods and slow car movement. The market in that direction, therefore, shows more life than at tidewater, and is likely to be more responsive to changes in the weather. Nothing has been heard of any canvassing for contracts for 1913-1914, but season prices on bituminous all-rail will probably be out before long.

The anthracite trade shows almost a reversal of form. Dealers are getting particular over the assortment of sizes in their cargoes, and cancelations are reported. Egg is in long supply, and there is some trouble between the companies who want to ship this grade and the dealers who don't want to receive it. Shipments are not any too plentiful, that is, they would not be if we were having a normal January, but the demand from the consumer is almost nil. Retailers are laying off men and teams and there is a lassitude about the trade that is more characteristic of June and July. Premiums are not heard of now, in the face of the companies freely offering to ship on old orders during February. There is a marked change in that respect from a week ago.

Current prices at wholesale are about as follows:

Clearfields, f.o.b. mine	$1.60@$1.75
Clearfields, f.o.b. Philadelphia	2.85@ 3.00
Clearfields, f.o.b. New York	3.15@ 3.30
Cambrias and Somersets, f.o.b. mine	1.70@ 1.80
Cambrias and Somersets, f.o.b. Philadelphia	2.90@ 3.10
Cambrias and Somersets, f.o.b. New York	3.20@ 3.35
Pocahontas, New River, f.o.b. Hampton Roads	3.00 and less
Pocahontas, New River, on cars Providence	4.25@ 4.50
Pocahontas, New River, on cars Boston	4.35@ 4.53

NEW YORK

Bituminous—There has been a slight increase in the stocks at tide water, and the market has shown a further absence of strength during the week. While quotations are being normally held at last week's level, there are rumors of operators making sales at a concession of 10c. on the off grades, with the better qualities still holding firm and difficult to obtain. This easing off of the situation continues to be ascribed to the unseasonable weather conditions. Had it not been for a pronounced shortage of equipment on the Pennsylvania lines, it is probable that this slump would have attained even greater proportion. A rather unique condition prevails in transportation circles; the supply of equipment on the New York Central has seldom been known to be better, while the Pennsylvania is failing utterly to meet the demands upon them for cars.

The weather continues to be the controlling feature in the market, and an abrupt fall in temperature would doubtless bring with it a sharp advance in quotations. There is still a scarcity of labor noticeable, but the men are working much better, petty strikes are less prevalent, and on the whole production in Pennsylvania is on the increase.

We continue New York quotations on the following basis with the low-grade soft coals rather weak as noted:

	Anthracite		Bituminous	
	Circular	Individual		
Broken*	$5.00	$5.00@5.10	West Virginia, steam	$3.05@3.25
Chestnut†	5.50	6.00@6.15	Fair grades, Penna.	3.15@3.25
Pea*	2.75	3.75@4.35	Good grade, Penna.	3.30@3.40
Buckwheat**	2.75	2.75@2.80	Best miller, Penna.	3.40@3.50
Buckwheat†	2.50	2.40@2.50	Georges Creek	3.50
Rice**	2.25	2.25@2.30		
Rice†	1.95	1.85@1.95		
Barley†	1.75	1.25@1.50		

* Scranton and Lehigh. ** Scranton. † Lehigh and Schuykill.

Anthracite—While the demand for hard coal still continues greatly in excess of the production, operators are slowly but surely losing control of the market, and providing no abnormal weather conditions appear within the next thirty days the trade will again be on a normal basis. Premiums are still being offered on some grades, although not in such a great amount, while, on the other hand, concessions below circular are readily obtainable on other sizes. Cancelations of orders seem to be increasing, while operators are continually facing the possibility of being caught with heavy consignments of demurrage coal on their hands. Such conditions, of course, have a tendency to force the market, with the re-

sult that buyers feel much easier. The smaller sizes are in practically full supply, while sellers are almost to the point of making concessions on egg in order to move it more rapidly.

Work in the mining regions continues to be interrupted by small strikes on the part of the miners. However, the companies are getting a plentiful supply of equipment for loading, and production is quite heavy.

PHILADELPHIA, PENN.

Cancelations are being received in depressing numbers, and dealers whose orders were being pushed with the large companies some weeks ago, are now tumbling over themselves to have them canceled. There is a noticeable falling off in the demand for all sizes, even pea coal, which up to a week or so ago, was in active demand, premiums being asked and freely given for reasonably prompt shipment. Stove and pea were about the only sizes for which there was any pressing demand at all, and even these are now becoming soft. Of course, there is considerable coal moving, and there is not anything as yet to indicate that the large companies are being compelled to stock, but a continuation of the present unseasonable weather is likely to pave the way for disposition of the coal into the storage yards.

However, that there is comparatively little coal in stock at the various yards, and a sudden flurry of snow, combined with a healthy fall in the thermometer, would likely bring about a condition similar to that existing a couple of months ago. Householders are economizing in their consumption of coal, hoping that the present weather will continue until spring, but this is doubtful. The last two winters in this vicinity has seen the heaviest snows, and the most strenuous weather conditions during the months of February and March, and it is not too much to say that the present light requirements will not answer later on in the season. The month of March, taking the last two years, has been as large as any of the so called winter months, in the consumption of fuel, and if it is any criterion, the present year will be the same.

There has been a marked reduction in the prices for bituminous coal, the market falling anywhere from 25 to 35c. off quotations of a week or two past, and unless there is a decided change in the weather, this price stagnation is likely to continue. Car supply at the mines seems to be fairly good, and the market apears to be in a fairly acceptable mood, although not insistent.

PITTSBURGH, PENN.

Bituminous—The market for prompt coal has eased off more, and shipment is obtainable at practically the contract prices, with the exception of slack, which frequently involves a small premium. Production is ample for all requirements, with a fair supply of labor and plenty of cars. Manufacturing demand is somewhat less than was expected, and it is inferred that the accumulating of stocks some time ago has operated to decrease the demand at this time. Regular prices remain quotable as follows: Slack, 90c.; nut and slack, $1.05; nut, $1.25; mine-run, $1.30; ¾-in., $1.40; 1¼-in., $1.55, per ton at mine, Pittsburgh district.

Connellsville Coke—Under pressure of materially increased production, coke prices have declined. Prompt furnace coke has been available at lower and lower prices in the past ten days, and late last week the decline was sharp, down to $3.50, at which fairly satisfactory brands could be purchased without difficulty. The market holds at this level, but in some quarters still lower prices are expected as conditions continue unusually favorable for production. There has been scarcely any inquiry for contract coke, although there are possibly some uncovered consumers who are holding off. Occasionally cut prices are offered by producers, but in general a definite contract market has not developed under the new conditions. Foundry coke is easier and more readily obtained. We quote, with contract prices practically nominal: Prompt furnace, $3.50; contract, first half, $3.25; year, $3; prompt foundry, $4@4.25; contract foundry, $3.25@3.75, per ton at ovens.

BALTIMORE, MD.

The continued open weather conditions again proved a serious handicap to the local market and caused a marked falling off in demand with a further drop in prices. The only thing which can give a better tone to the market is a spell of severe weather, but the weather man promises no relief in this way.

The scale of prices for the week was about 10c. lower on all grades, and even then consumers were not particularly interested.

Of course, the usual supply of coal is moving under contract, and prompt deliveries are now the rule. Train movements are as good as they usually are in midsummer, and roads seem to be able to supply all equipment desired by operators. Operators are experiencing difficulty in getting sufficient miners to produce the coal in quantities to meet an easy market, and this would be much more acute should the demand suddenly increase. West Virginia companies are doing everything to divert miners to their properties in that state.

BUFFALO, N. Y.

The coal market is quiet, due almost entirely to the weather. Everybody agrees that a good snowstorm would firm prices and restore the demand in both anthracite and bituminous. The weather has also assisted the railroads in moving coal, and they have almost entirely caught up with business, so that there is now some unsold bituminous at various points for the first time in months. Certain enterprising jobbers have lately busied themselves picking up what they could of this consignment coal and getting it off the market.

The bituminous market has not broken to any extent, and if steady weather should set in at once the sag would straighten out rapidly, for the consumption is as large as ever and promises to continue. Iron furnaces are running full blast and the demand for all classes and grades of iron and steel is as active as ever. The operators are doing what they can to flood the market with coal, but are not able to get much surplus as yet.

Everybody is anxious for cold weather, but none is expected for several days. This state of things affects anthracite most, but it slows down business generally as well. Already the complaints that the railroads are confiscating coal have ceased and blockades are forgotten.

The bituminous trade is agreed that prices are at least 10c. off and not strong at that, quotations being $2.90 for select lump, $2.75 for three-quarter, $2.65 for mine-run and $2.25 for slack. ,Coke is tending downward, though mainly on account of excessive prices of late; quotations are based on $6 for best Connellsville 72-hour foundry. Allegheny Valley coal is quite as active and strong as Pittsburgh, at about 25c. less.

The premium on independent anthracite is about 50c. on stove and 25c. on chestnut, egg selling at circular at the mines, with jobbers adding a little for their profit. It appears that the extra prices paid for this class of coal are about at an end, which means that the large companies are pretty nearly caught up with their orders and will remain so till some actual coal weather appears. All complaints from this or that isolated district of being out of coal have disappeared.

COLUMBUS, OHIO

Mild weather has softened the coal trade in Ohio still farther and as a result quotations took another tumble. Prices are weak generally, and particularly so in the domestic grades. Dealers have large stocks on hand, and as a result are not inclined to buy to any extent now. In fact, orders for future delivery, which were placed earlier in the month, are generally being canceled.

The steam trade is still strong although quotations have sagged considerably in sympathy with domestic coal. Manufacturing establishments are taking about as large a tonnage as usual, although they are not stocking up any. Factories engaged in iron and steel lines are the best buyers of steam grades. The tonnage required by railroads is also large and the freight movement is holding up well.

Production in the various mining districts of the Buckeye State has been hampered by lack of demand and, consequently, it is estimated that it is less than 50 per cent. of normal. In the Hocking Valley the output was fairly large and somewhat above that figure. In eastern Ohio steam business is good and there was a fair production, while in other districts, which cater more to the domestic trade, the output was low.

Quotations in the Ohio fields are as follows:

	Hocking	Pittsburgh	Pomeroy	Kanawha
Domestic lump	$1.75	.....	$1.75	$1.65
¾-inch	1.50	$1.30	1.50	1.40
Nut	1.35	.....	1.50	
Mine-run	1.20	1.15	1.25	1.20
Nut, pea and slack	1.15	.....	1.15	1.10
Coarse slack	1.05	1.15	1.05	1.00

CLEVELAND, OHIO

The unseasonable weather had a drastic effect on the market during the past week and prices fell off from 5c. to 10c. a ton on all grades of coal. The flood that devastated the Ohio valley prevented a violent decline. A few weeks ago high premiums were being paid, but with the stringency of the car supply less noticeable, coupled with the spring-like weather, premiums have disappeared and sales organizations

are having difficulty in keeping the mines supplied with orders.

Coal men are convinced that dealers have overbought and do not look for an improvement in the domestic market until the cold weather arrives.

Wholesale quotations per short tons, f.o.b. mines, are as follows:

District.	Freight rate	¾-in.lump	Mine-run	Slack
Youghiogheny	$1.00	$1.30	$1.20	$1.00
Pittsburgh No. 8	0.90	1.10	1.00	1.00
Goshen No. 6	0.70	1.24	1.15	1.00
Coshocton	0.70	1.70	1.45	1.10

Massillon lump is quoted at $2.50 mines. Pocahontas lump and egg is sold at $2, run-of-mine $1.25, and slack 90c. at the mines. Hocking lump has dropped to $1.55, mines. Prices on furnace coke dropped to $3.25 f.o.b. ovens with about $1 added for foundry grade. Coal sales people are holding up quotations on contract business, realizing that prices will again take a decided jump upward at the opening of navigation. This will take a large tonnage off the rail market and improve conditions generally.

HAMPTON ROADS, VA.

The continued warm weather, good loading at the mines and prompt movement by the railroads have all contributed to a still further lowering of tidewater prices, $2.80 f.o.b. per long ton being offered and sales made at $2.90 to $3.05. Inland business is now being sought and some contracts have already been taken from Apr. 1 to Dec. 31. The change in the contract year has been determined upon so as to make all contracts after 1913 effective during the calendar year. The price of standard New River-Pocahontas coals on inland contracts seems to be settled at $1.25 per net ton, an advance of 15c. over this contract year.

Now that the Chesapeake & Ohio Ry. is open to the west and the bridge that caused the diversion of tonnage is again in service, the movement of Kanawha coal to tidewater has about ceased. This is offered at $2.70 per gross ton and a sale of 5000 tons was made last Monday at $2.75 less commission, about $1.25 f.o.b. mines per long ton. Local prices for the new contract year do not seem to have been settled as yet, but they will probably be $1.25 per net ton, f.o.b. mines, an advance of 15 cents.

The report that the Italian government had contracted for 200,000 tons of American coal has been confirmed and the entire tonnage will be shipped from Hampton Roads.

LOUISVILLE, KY.

The continuance of mild rainy weather in this vicinity has further depressed the market, to an unusually low point. With several weeks of quite moderate weather, and small demand for heating coal, the domestic consumption has fallen away to practically nothing. Dealers report that their supplies are all but untouched, and that their sales are hardly 25 per cent. of what they usually are at this period of the year.

The prices being quoted on nut and slack indicate pretty accurately the state of the market. Eastern Kentucky nut and slack is selling at 90c. to $1.05, according to grade; and western Kentucky is in good demand at 85c., while the Indiana variety, which is usually not wanted here, is being offered at about the same price. Eastern Kentucky block can be had for $1.75@2; lump, $1.65@1.75; round, $1.50@1.65; and mine-run, $1.25.

Indications are for colder weather, and this seems to be about the only salvation for the coal interests here. But even if the entire month of February should be genuinely wintery, this will be poor consolation for having lost practically all of the fall and early winter through a car shortage, and the month of January by unseasonable weather.

BIRMINGHAM, ALA.

The warm weather still continues and there is a growing uneasiness among the domestic dealers and operators, lest we should have no more real winter. There is a healthy demand for both steam and coking coals, and many mines are producing record outputs. The market for these grades of coal seems to broaden from day to day and the products of newly opened mines find a ready market.

Coke is the most active commodity in this district. The output at the present time is above all previous high records and bids fair to go still higher. There is an export inquiry here for approximately 300 tons per day of smelter coke and if this order is secured it will take practically all the available surplus; it is reported that the figure asked is $4, local ovens. Some foundry-coke sales have been reported as high at $4.50 ovens for spot shipment, which is the highest price received for coke in this district since the early part of 1907.

The steam coal and coke markets are being stimulated by the record number of blast furnaces now in operation in this district. The 1912 production of pig iron was considerably higher than any previous year and an additional furnace will be blown in during February.

INDIANAPOLIS, IND.

The dullness of the coal trade here is the worst ever known for January in the history of the industry. One operator who has just returned from an extensive trip, said he found retailers' yards full and much coal on the road still coming to them and that he expected to close down his mine. On mine shipments, operators can get out without a loss, but those consigning their coal cannot get cost out of it. Operators say it is too late now to recover this winter. Retailers bought heavily early in the season, stimulated by the car shortage, and are overstocked almost without exception.

The steam grades are much better than the domestic. Factories are busy; but are using 25% less fuel than last winter on account of the mild weather. Mines that can put in half time or better fom now on will be in luck. Operators are giving their attention now to selling for next season. One of the novel situations is that five cars of anthracite coal are held for demurrage at Columbus, Ind., and are offered at a bargain. Indiana prices, f.o.b. mines are:

No. 4 mine-run	$1.10	Domestic lump 5- and 6-in.	$1.65
Nos. 5 and 6 mine-run	1.00	Screenings, No. 4	0.70
No. 4 steam lump, 1½-in.	1.25	Screenings No. 5 and 6	0.60
Nut, No. 4	1.30	Washed coal, Nos. 1 & 2.	$1.75@2.00
Egg	1.40	Brazil block	2.20
Domestic lump 2½-in.	1.50		

CHICAGO

Quietness prevails in both the steam and domestic coal markets in Chicago. Several railroads operating their own mines have closed them down and a number of lines, which have been purchasing coal under a maximum and minimum contract, are now taking the minimum.

There has been an increase in the cancelation of orders for anthracite coal. Dealers say they are lacking in storage space. Smokeless mine-run is firm at $1.50@1.60, while lump and egg is selling at from $1.75@2. There has been a reduction of between 5c. and 10c. a ton in mine-run and steam lump coal of the Springfield variety. On account of a small production of lump, screenings have advanced from 5c. to 10c. a ton. Prices in the coke market are steady, but there has been a decline in the volume of sales. Gas-house coke has been cut to $5.85. Fair prices are being paid in the West for splint coal in box cars. There is comparatively little demand for Hocking Valley coal, prices remaining close to $1.75, the mines.

Prevailing prices at Chicago are:

	Sullivan Co.	Springfield	Clinton	W. Va.
4-in. lump	$2.62	.....	.....	.....
Domestic lump	.....	$2.32	$2.27	.....
Egg	2.52	.....	.....	$3.80 @ 4.05
Steam lump	2.07 @ 2.17	2.02	2.17	.....
Mine-run	.....	1.87	1.97	3.55 @ 3.65
Screenings	1.77 @ 1.87	1.62 @ 1.67	1.62	.....

Coke—Prices asked for coke are: Connellsville and Wise County, $6.50@6.75; byproduct, egg, stove and nut, $5.75@6; gas house, $5.85.

MINNEAPOLIS-ST. PAUL

The retailer in the Twin Cities and in the country has done a nice, steady business, and while not rushed, he is enjoying a steady trade and will make money before the winter is over. The wholesale trade is quiet, as has been the general condition ever since the record-breaking month of November. The much hoped for cold weather does not seem to make its appearance, and coal men, while trying to keep a stiff upper lip and smile, find it very difficult with the thermometer registering 50 deg. above zero.

Prices on all grades of coal, with the possible exception of hard coal, are weak. This includes soft coals at the docks, which are reported below circular, as well as Illinois and Eastern grades. Demurrage coal is to be had at low prices, this being a secondary consideration if the coal can be moved. Smokeless is sold at the docks for from 25c. to 50c. below Jan. 1 circular. Franklin County lump, egg and No. 1 nut is selling at from $1.40 to $1.50, and Carterville in the same sizes is quoted at $1.40.

DETROIT, MICH.

Bituminous—Detroit dealers and steam consumers have bought less coal in the last two weeks than over any similar period for the past two years, not even excepting the summer time. About the only thing worth featuring in the market here today is the scarcity of the slack. This perhaps is due to the floods which have made it impossible for the railroads to handle cars, thus necessitating the shutting down of some mines.

The local market is quotable on about the following basis:

	W.Va. Splint	Gas	Hocking	Cambridge	Pitts. No. 8	Pocahontas	Jackson Hill.
Lump	1.35	....	1.40	....	....	2.00	2.25
Egg	1.35	....	1.40	....	....	2.00	2.25
Nut	1.50	....	1.50	....	....	....	....
¾ lump	1.10	1.10	1.10	1.10	1.10	....	....
Mine-run	0.90	0.90	....	1.00	1.00	1.25	....
Slack	1.00	1.00	1.00	1.00	1.00	Open	....

Anthracite—The movement of anthracite is still slow and should the extremely cold weather which was promised, materialize, the supply in the local yards would soon be exhausted.

Coke—The demand for this article is falling off rapidly. Some of the local ovens are still shut down. Connellsville is being reported at $4, Solvay $4.25, and Gas House $4, f.o.b. ovens.

ST. LOUIS, MO.

There is absolutely no demand for coal either in the city proper nor in the country; several mines in the Standard field have shut down until conditions get better, and the same applies to a few operations in the Carterville district field. At no time during the past summer was the condition of the coal market any worse than it is right now.

Carterville and Franklin County lump and egg have been selling as low as $1.10 at the mines, with nut coal at $1, screenings at 75c. and mine-run at $1. These prices are below the cost and the overproduction in the field will continue to force prices down in order to move a tonnage that could be sold just as easily at 25c. per ton more if the production was under control.

The prevailing market is as follows:

	Carterville and Franklin Co.	Trenton and Big Muddy	Mt. Olive	Standard
2-in. lump	.....	.....	.....	$1.00
3-in. lump	.....	.....	$1.35	.....
6-in. lump	$1.20 @ 1.30	.....	1.50	1.20
Lump and egg	1.45 @ 1.60	$2.00	.....	.....
No. 1 nut	1.05 @ 1.15	.....	.....	.....
Screenings	0.75 @ 0.85	.....	.....	0.60
Mine-run	1.00 @ 1.10	.....	.....	0.90
No. 1 washed nut	1.30 @ 1.40	.....	.....	.....
No. 2 washed nut	1.40 @ 1.50	.....	.....	.....
No. 3 washed nut	1.35 @ 1.45	.....	.....	.....
No. 4 washed nut	1.00 @ 1.10	.....	.....	.....
No. 5 washed nut	0.75 @ 0.85	.....	.....	.....

OGDEN, UTAH

Real winter weather is prevailing over the territory west of the Mississippi and so far January has been a good month for the mine operators. The consumption about equals the production and there are steady shipments, from all districts.

About the middle of January, Nebraska was visited by a cold spell and dealers were able to clean up their storage coal. This has caused orders to be placed at the mines and shipments east from the Wyoming district are at a maximum.

Mines in Colorado report an abundance of orders and plenty of coal. The shortage of anthracite is noticeable in Nebraska and the dealers are compelled to handle a lot of premium coal. This has also increased the demand for the high-grade bituminous coal.

The continued cold weather has created a fair demand for slack and there are no indications of a surplus, although there are days that none can be loaded on account of the routing on the cars. Nut grade is moving nicely with none on track at the mines.

Both Utah and Wyoming prices continue strong as follows: Lump, $2.75; nut, $2.25; mine-run, $1.85. Wyoming slack brings $1, with Utah 25c. higher.

PRODUCTION AND TRANSPORTATION STATISTICS

CONNELLSVILLE COKE

The "Courier" reports production and shipments in the Connellsville region for the week ended Jan. 25, as follows:

Production (tons)	Week	4 weeks	*Shipments (cars)*	Week	4 weeks
			Pittsburgh	4,303	17,322
Connellsville	229,940	1,003,675	W. of Pittsburgh	7,117	27,348
Lower Connellsv'le	186,342	742,300	E. of Region	870	3,613
Total	416,282	1,745,975	Total	12,290	48,283
Same period 1912	376,597	1,395,120		11,113	40,920

The Car Situation

American Ry. Association reports surpluses and shortages of coal equipment for 2 weeks ended Jan. 15 as follows:

	Surplus	Shortage	Net Surplus
New England Lines	137	173	*36
N. Y.; N. J.; Del.; Md.; Eastern Penn	1,653	1190	463
Onio; Ind.; Mich.; Western, Penn	1,694	531	1,163
W. Va.; Va.; N. & S. Cal	768	442	326
Ky.; Tenn.; Miss.; Ala.; Ga.; Fla	538	653	*115
Iowa; Ill.; Wis.; Minn.; N. & S. Da	2,083	502	1,581
Mont.; Wyo.; Neb	109	10	99
Kan.; Colo.; Mo.; Ark.; Okla	2,089	0	2,089
Texas; La.; N. Mex	398	8	390
Ore.; Idaho; Calif.; Ariz	2,682	0	2,682
Canadian Lines	0	0	0
Totals	12,151	3509	8,642
Same period 1912	64,719	88	64,631

*Shortage.

FOREIGN MARKETS

GREAT BRITAIN

Jan. 17—The market continues very firm in all departments. A great deal of attention is being paid to the arrangement of February stems. Quotations are approximately as follows:

Best Welsh steam	$4.68	Best Monmouthshires	$4.26
Best seconds	4.50	Seconds	4.14
Seconds	4.38	Best Cardiff smalls	3.60
Best dry coals	4.62	Seconds	3.36

The prices for Cardiff coals are f.o.b. Cardiff, Penarth, or Barry, while those for Monmouthshire descriptions are f.o.b. Newport; both exclusive of wharfage, and for cash in 30 days —less 2½%.

British Exports—The following is a comparative statement of February stems. Quotations are approximately as 1912 in long tons:

	Year		December	
	1911	1912	1911	1912
Anthracite	2,454,523	2,547,712	221,359	230,803
Steam	47,119,017	46,539,983	4,255,301	4,210,920
Gas	10,504,172	10,559,845	910,050	829,435
Household	1,540,710	1,639,571	166,491	141,763
Other sorts	2,980,844	3,157,893	240,710	284,447
Total	64,599,266	64,445,004	5,793,911	5,697,368
Coke	1,059,876	1,026,021	115,956	97,409
Manufactured fuel	1,612,741	1,565,432	130,912	171,400
Grand total	67,271,883	67,036,457	6,040,770	5,966,177

COAL SECURITIES

The following table gives the range of various active coal securities and dividends paid during the week ending Jan. 25:

Company	Week's Range High	Low	Last	Year's Range High	Low
American Coal Products	90	90	90	....	....
American Coal Products Pref	111	111	111	....	....
Colorado Fuel & Iron	35	31⅞	34¼	36	31
Consolidation Coal of Maryland	102⅞	102⅞	102⅞	102⅞	102⅛
Island Creek Coal Pref	86	85	85	....	....
Lehigh Valley Coal Sales	240	204	204	....	....
Pittsburgh Coal	22⅞	21¼	22¼	24⅛	21⅛
Pittsburgh Coal Pref	89⅞	88	89⅛	95	87
Pond Creek	26¼	24⅜	25	28¼	24¼
Reading	165⅝	160⅞	164⅛	168⅞	160⅛
Reading 1st Pref	90⅝	90⅛	90⅛	90⅛	90
Reading 2nd Pref	....	....	....	93	91
Virginia Iron, Coal & Coke	53½	52⅞	52⅞	53½	52

Bonds Company	Closing Bid	Asked	Week's Range or Last Sale		Year's Range	
Colo. F. & I. gen. s.f.g 5s	99	102	98	98	97	100⅜
Colo. F. & I. gen. 6s	101½	....	107¼	June '12	107¼	107¼
Col. Ind. 1st & coll. 5s. gu	83¼	....	83½	84	72½	85½
Cons. Ind. Coal Me. 1s 5s	....	84½	85	June '11	....	....
Cons. Coal 1st and ref. 5s	....	94	93	Oct. '12	93	94
Gr. Riv. Coal & C. 1st g 6s	94	100	102⅜	Apr. '06	....	....
K. & H. C. & C. 1st s f g 5s	....	....	98	98	97½	98½
Pocah. Con. Coll. 1st s f 5s	87½	88	87⅜	Jan. '13	81½	89½
St. L. Rky. Mt. & Pac. 1st 5s	77¾	78½	77½	77½	79½	84½
Tenn. Coal gen. 5s	102	103½	102½	103	101⅛	103
Birm. Div. 1st consol. 6s	103	Sale	103	103	102⅛	104
Tenn. Div. 1st g 6s	101½	103¾	101¾	Dec. '12	101¾	104
Cah. C. M. Co. 1st g 6s	....	....	110	Jan. '09	....	....
Utah Fuel 1st g 5s	....	....	....	....	....	....
Victor Fuel 1st s f 5s	....	83	85½	Oct. '12	85½	86
Va. I. Coal & Coke 1st g 5s	97	Sale	96½	97	94½	98½

Jefferson & Clearfield Coal & Iron Co.—Dividend on preferred of 2½% payable Feb. 15, to holders of record, Feb. 7.